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TRANSACTIONS MATRIX DESCRIPTION OF THE NATIONAL SYSTEM OF PHYSICAL MEASUREMENTS

Raymond C. Sangster

Office of the Deputy Director
Institute for Basic Standards
National Bureau of Standards
Boulder, Colorado 80302

August 1976

Technical Report in Connection with the
BS Study of the National Measurement System,
972-1975

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Technical Report in Connection with the
IBS Study of the National Measurement System,
1972-1975

U.S. DEPARTMENT OF COMMERCE, Elliot L. Richardson, Secretary
Edward O. Vetter, Under Secretary
Dr. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Acting Director

FOREWORD

The concept of a National Measurement System has, for many years, provided a useful focus for the considerations important to physical measurements in our technology intensive economy. Dr. R. D. Huntoon, in his October 6, 1967, article in Science, emphasized the basis for a systems viewpoint in interrelated measurements activities and the idea has continued to evolve. Today, we think of the U.S. National Measurement System in terms of all the intellectual, functional and institutional activities which involve measurements throughout our society. Moreover, we seek to understand more completely the structural nature of this system and its architectural needs.

There have been a number of approaches to the study of our national system for physical measurements. The present series of studies was initiated in 1972 by Dr. Ernest Ambler, then Director of the Institute for Basic Standards. It was Dr. Ambler's purpose to organize the essential information necessary for the effective management of NBS resources and to promote the direct interaction between IBS staff members and the communities of users they serve.

This document reflects the results of the intensive studies carried out during the period from 1972 - 1975. It is important to recognize that the National Measurement System is extremely complex having widely distributed elements and impacts. The detailed analysis of this system is well beyond the state-of-the-art of econometric modeling, and therefore, any study, no matter how intensive, is necessarily incomplete. Nevertheless, the information which is now in hand provides an important addition to our capability for planning and implementing the programs of IBS. It also represents a growing foundation upon which we can continue our efforts to build a more effective structure.

A. O. McCoubrey
Director, Institute for Basic Standards
National Bureau of Standards
August 1976

PREFACE

The 1972-75 Study of the National Measurement System by the NBS Institute for Basic Standards has been a massive effort involving many people in all divisions of the Institute. The information compiled in this document is one of the results of this effort, and could never have been developed without the contributions of a large number of knowledgeable individuals.

The Study was organized around a central coordinator and a group of "National Measurement System Study representatives" from the technical divisions of the Institute. The initial central coordinator was Dr. James R. Seed, a Presidential Interchange Executive from the Dow Chemical Company, on temporary assignment to the National Bureau of Standards. Dr. Seed was responsible for the initial formulation of the tactical plans for this Study, and carried the project through to the generation of a complete set of comprehensive reports on the structure and operation of the various portions of the System, in December 1973. In August 1974, I took over the central coordinator position and worked with the Study representatives, to round out the pattern of the Study and to develop the final reports which are now being issued by NBS for the different areas of measurement interest.

The roster of Study representatives responsible since 1974 (the originators of the data presented in this report) - and their fields of interest and NBS divisional affiliations - is the following:

Allan S. Risely - Time and Frequency (Time and Frequency Division)
John W. Lazar - Length and Related Dimensional Measurements (Mechanics Division)
John D. Ramboz - Vibration and Shock (Mechanics Division)
Russell D. Young - Surface Finish (Mechanics Division)
James R. Whetstone - Mass, Volume and Density (Mechanics Division)
Donald E. Marlowe - Force (Mechanics Division)
William C. Haight - Fluid Flow (Mechanics Division)
Peter L. M. Heydemann - Pressure (Heat Division)
James F. Schooley - Temperature (Heat Division)
Arnold Wexler - Humidity and Moisture (Heat Division)
Max Klein - Thermodynamic Properties of Fluids (Heat Division)
Thomas M. Flynn - Cryogenics (Cryogenics Division)
Norman B. Belecki - Electricity (Electricity Division)
Francis X. Ries - Electromagnetics (Electromagnetics Division)
Harold S. Boyne - Electromagnetics (Electromagnetics Division)
Paul A. Hudson - Medical Ultrasonics (Electromagnetics Division)
David S. Pallett - Acoustics (Institute Office)
Henry J. Kostkowski - Radiometry and Photometry (Optical Physics Division)
William H. Venable - Spectrophotometry (Optical Physics Division)
William R. Ott - Far Ultraviolet Radiometry (Optical Physics Division)
Dennis A. Swyt - Optics (Optical Physics Division)
Robert J. Mahler - Lasers (Time and Frequency Division)
Arthur V. Phelps - Physical Properties of Atoms and Molecules (Lab. Astrophysics Div.)
John W. Cooper - Physical Properties of Atoms and Molecules (Optical Physics Division)
Cedric Powell - Surface Properties (Optical Physics Division)
Randall S. Caswell - Ionizing Radiation (Center for Radiation Research)

Please note that the matrices presented in this report may not be identical to those included in the individual reports for which the individuals listed above are responsible. In part, this is due to differences in definition of some of the measurement user sectors--the individual reports use sectors appropriate for their fields, I used a common set of sectors for all fields. In addition, there may be a few specific cases of discrepancies in numerical values: in the summary matrices (this report) my overall judgment may have indicated that a borderline decision go one way, while in the individual sector report the author's judgment went the other way.

I and the Study representatives trust that the readers of this document will not place excessive reliance on specific individual numbers presented herein. These code numbers all represent quantifications of qualitative judgments, and any given number has perhaps one chance out ot three being either too high or too low. Nevertheless, we believe that the quantification, represented by these matrices, of a vast amount of accumulated NBS wisdom, is worth putting on the record for others to use.

Raymond C. Sangster
August 1976

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TRANSACTIONS MATRIX DESCRIPTION
OF THE
NATIONAL SYSTEM OF PHYSICAL MEASUREMENTS

Raymond C. Sangster
NBS Institute for Basic Standards

EXECUTIVE SUMMARY

Direct measurements transactions matrices have been developed to describe the U.S. national system of physical measurements. Three primary axes have been used: A. *Suppliers* of measurement information, goods, or services. B. *Users*. C. *Measurement Sectors* (kinds of measurement quantity) being described. These three axes define three different kinds of matrices: I. The matrix for a *given measurement sector*, showing the exchanges of measurement information, goods, and services between suppliers and users in that sector. II. The matrix for the *inputs to a given user sector*, from all of the different supplier sectors, for all of the measurement sectors. III. The matrix for the *outputs of a given supplier sector*, to all of the user sectors, for all of the measurement sectors. A summary supplier-user matrix has been generated by summing over all of the physical measurement areas studied, plus use of independent economic data.

Semi-quantitative estimates are entered in the intersection boxes in the matrices for the following quantities: (a) Magnitude of transactions involved. (b) Rate of change of that magnitude. (c) Relative importance or criticality of transactions, independent of magnitude. (d) Adequacy of transactions. Basically, a five point (0-4) logarithmic scale has been used; a change by one unit correlates approximately to a change in magnitude, for instance, by a factor of three. Most estimates of these code entries have been made on the basis of intuitive, informed judgment. Approximately speaking, there is one chance out of three that any given estimate is improper -- either too high or too low. Zeros have been suppressed in these tables, so that a blank box means an estimate of a negligible transactions magnitude.

The measurement sectors studied are these:

- Time and frequency
- Length and related dimensional measurements
- Vibration and shock
- Surface finish
- Mass, volume and density
- Force
- Fluid flow
- Pressure
- Temperature
- Humidity and moisture
- Thermodynamic properties of fluids
- Cryogenics
- Electricity
- Electromagnetics
- Medical ultrasonics
- Acoustics
- Radiometry and photometry
- Spectrophotometry
- Far ultraviolet radiometry
- Optics
- Lasers
- Physical properties of atoms and molecules
- Surface properties
- Ionizing radiation

The supplier and user sector lists have been defined to be identical. As a result, all of the intra-sector transactions are explicitly accounted for, in the diagonal elements of the supplier-user matrices, and all of the user needs information feed-back transactions between the users and suppliers of goods and services are entered. Standard Industrial Classification (SIC) categories have been used whenever possible. The supplier-user categories employed are the following:

- Knowledge community
- International metrological organizations
- Documentary standardization organizations
- Instrumentation industry
- NBS
- Other U.S. national standards authorities
- State & local office of weights & measures
- Standards & testing laboratories & services
- Regulatory agencies
- Department of Defense
- Civilian federal government agencies
- State and local government agencies
- Industrial trade associations
- Agriculture, forestry, fishing; mining
- Construction
- Food, tobacco, textiles, apparel, lumber, furniture, paper, leather
- Chemicals, petroleum, rubber, plastics, stone, clay, glass
- Primary & fabricated metal products
- Machinery, except electrical
- Electric and electronic equipment
- Transportation equipment
- Transportation and public utilities
- Trade, retail & wholesale; insurance, finance, real estate; other services; printing & publishing
- Health services
- General public

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR NATIONAL SYSTEM OF PHYSICAL MEASUREMENTS (March 1976)

USES / SUPPLIERS

SUPPLIERS	USES	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.		4 1 6 2	3 1 2 1	3 1 3 2	2 1 3 1	4 1 4 2	1	1	2 1 2 1	3 1 2 2	3 1 3 1	3 1 2 1	2 2 1 2	2 2 1 2	1 1	2 1 2 1	3 1 2 1	2 1 3 2	3 1 2 1	2 1 3 2	3 1 3 1	2 1 2 1	3 1 2 1	2 1 1 1	2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS		2 1 1 1	3 1 3 1	3 1 2 2	2 2 1 1	3 1 3 2	1			1	1	1			1					1			1		
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		3 2 1 2	3 2 2 1	3 2 3 1	3 1 3 1	3 1 2 2		3 1 1	3 1 2 2	3 2 2 1	3 1 2 1	2 1 2 1	1 2	3 1 2 2	1	2	2	2 1 2 1	2	2 1 2 1	2 1 2 1	2 1 2 1	3 1 2 2	1	2	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)		2 1 1 1	2 1 2 1	2 1 2 2	4 1 5 2	3 1 3 2	1	1	3 1 2 2	3 1 2 2	3 1 5 2	3 1 4 1	3 2	2 1 2 1	3 1 3 2	1	3 1 3 2	3 1 3 1	3 1 4 1	3 1 5 1	3 1 5 2	3 1 5 1	3 1 5 2	3 1 4 2	3 1 4 2
5 NBS		3 1 3 1	3 1 3 2	3 1 3 2	3 1 3 2	3 1 4 1	3 1 1 1	4 2 3 2	3 1 3 2	3 1 2 2	3 1 3 2	2 1 3 2	1 1	2 1 2 2	4 1 1	2 1 2 2	2 2 4 2	2 1 2 2	4 3 4 2	2 1 2 1	3 1 2 1	4 1 4 2	4 2 4 2	3 4 3 2	2 1 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES		1	1			3 1 3 1 1	1		1	1	2	1	1	1	1	1							1	1	
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)			1	1	3 1 1 R	4 2 1 R		4 2	1	1			3 1 1	1	1	1	3 1 2	1		3 1 1		1	2	4 3 1		4 1 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES		2 1 1	2 1 2 3 1	2 1 2 1 R	3 1 2	3 1 2 R			3 1 3 2 1	2 1 2	3 1 3 2 1	3 1 2 1	3 2	1	1	1	2 1 2	3 1 2 2	3 1 1	3 1 2 3	3 1 1	3 1 2 3	3 2 2 1	3 1 3 2		
9 REGULATORY AGENCIES (excl. OWM's)		3 1 2	3 1 2 2	3 1 3 2 R	3 2 2 R	3 2 2 R			3 1 2 R	3 2 3 1	2 1 3 1 R	2 1 2 2 R	2 1 2 R	2 2 R	4 2 2 1 R	4 2 4 1 2 R	4 2 2 1 R	3 1 3 2 2 R	3 1 2 1 R	4 1 2 2 R	3 1 3 2 2 R	3 1 3 1 2 R	3 1 4 2 2 R	3 1 2 2 R		
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		3 2 2	3 1 3 2 1 R	3 1 3 2	2 1 3 R	2 1 3 1 R	1		3 1 3 R	1 1	3 1 7 1 R	3 1 2 1	2 1 1				2 1 1 R	3 1 3 1 R	3 1 2 2 R	3 1 3 1 2 R	2 1 2 R	2 R	1 R		
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		3 1 2 1	2 1 2 2	2 1 2 2	2 1 3 1	3 1 3 1	1		2 2 2 1	2 1 2	2 1 7 2	3 1 2 1	2 1 2	1	2 1	1	2 2 3 2	3 1 3 1 2 1	3 1 2 1	3 1 3 1 2 1	4 1 4 1	1	2	2 3	
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1	1	1	1 R	2 1 1 R	1	1 R	1	1	1	1	3 6 2	1	1	2	1	1	1	1	1	1	1	1	1	1
13 INDUSTRIAL TRADE ASSOCIATIONS		2 1 1	2 1 3 2	2 1 2 2	2 1 2	2 1 2	1	1	3 1 1 2	2 1 2	2 1 1 2	2 1 1 2	2 2 1 2	2 1 2	1	1	1	2 1 1	1	2	2 1 2 1	2 1 1 1	1	1	1	1
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)		1	2 1 1	1	1 R	2 2 1 R		1 R	1 R	1	1	2	1	1	2 5	1	2	2	2	1	1	1	2	1		1
15 CONSTRUCTION (SIC Div. C)		1	1	1	1 R	1	1	1 R	1 R	1	1	1	1	1	1	6		1	1	1 R	1	1	1	1	1	1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)		1	3 1 3 1 1	3 2 1 2 R	2 1	3 2 2 R		2 1 R	2 3 1 R 2	1	1	1	3 1 2 2	1	1	1	2 6 1	1	1 R	1	1 R	1	1 R	1		2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)		2 1 1 2	2 1 2 1 2 1	3 2 2	2 1 2	3 2 2		1	2 2 2 2	1 2 2	1 2 2	1	2 1 1	1	2	1	1	2 6 1	1	1	1	1	1	1	1	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2 1 1	3 1 2 2	3 1 2 1 R	3 2 2 R	3 1 2		1	3 1 2 R	2	3 1 2 2 1	1	2	2	2	1	1	1	3 6	2 1 1	1	3 2	2	1	1	6
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 1	3 1 2 2	3 1 2 1 R	3 2	2 1 2 R		1	2 1 1	1	3 1 1 1	1	2	2	2	1	1	1	2	3 1 6	2	3 2	2	2	1	2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)		3 1 2	3 1 2 2	3 1 2 3	3 1 2	3 1 2			3 1 3 1 2 1	2	3 1 3 2	1	3 1 2	1	1	1	1	1	1	2	3 6 3	3 2 2	2	1	2	2 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2 1 2 1	2 1 2 2	2 1 1 1 R	2 1 2	2 1 2 R		1	2 1 2 R	1 2 2	2 1 2 2	1 2 1	1 2 1	1	3 1	1	1	1	2 1 1	2 1 1 1	1 3 1 2	3 6 1 1	3 2	1		1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)		2 1 2	2 1 2 2 1 R	2 1 2 2	2 1 3 1	2 1 3 2		1	2 1 3 2	2	2 1 2	1	2	2	2	1	1	1	1	1	1	2 1 2 1	3 1 6 1	2	1	3 1 4 1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, Bal. I, 27)		1	1	1	1 R	2 1 3 1		1 R	1 R	2 1 1	1	1	1	1	1	1	2	2	2	1	1	1	2	7	1	6
24 HEALTH SERVICES (SIC Major Gp 80)		1	1	2	1 R	4 2 3 R			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	2	
25 GENERAL PUBLIC			1 R	2 R		2 1 1 R		1 R	2 1 1 2 R		1 R	2 R	1 R		1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	2 R	2 R	1 R	2 1 7 1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS / SUPPLIERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4-7 = Major

1. INTRODUCTION

The U. S. National Measurement System is defined as comprising all of the activities and mechanisms -- intellectual and operational, technical and institutional -- used by this country to produce the physical measurement data needed to create the objective, quantitative knowledge required by our society. Studies of the measurement related activities performed by our labor force suggest that this system accounts for some six percent of our gross national product. This report presents in an input-output format a semi-quantitative picture of the direct transactions in this system.

The current comprehensive study by the NBS Institute for Basic Standards of the U.S. national system for physical measurements was launched in 1972 for the explicit purposes of increasing the understanding and improving the support by NBS of this system. A series of "microstudies" of different kinds of measurement quantities was implemented to determine how they were used in our society and the nature of any improvements that might be needed in their measurement to increase the effectiveness of the measurement system. Each of these microstudies prepared in an input-output format an estimate of the size and nature of the transactions involved for its particular field of measurement. From these estimates and other data sources, the charts of this report were developed.

2. SUPPLIERS, USERS, AND DIRECT MEASUREMENTS TRANSACTIONS

The measurement transactions matrices display the direct interactions among the various suppliers and users of measurement information, data, goods, and services. The following categories appear to encompass all of the kinds of goods and services that are involved in these *measurements* transactions:

A. End-use measurement data
B. Reference data
C. Other measurement services (e.g., calibrations or time and frequency broadcasts)
D. Reference materials
E. Measurement instrumentation and its associated software
F. Measurement *how-to* information
G. Measurement *requirements* information (e.g., laws, regulations, documentary standards)
H. Measurement *needs* information
I. Money to pay for the above

In developing the matrices for these studies, attention was focused on the functional measurements information, goods, and services involved in the transactions. The last item -- money -- was ignored. Also, only *direct* transactions are presented (i.e., A may do something for B, who does something for C, so that indirectly A has done something for C, but there is no direct transaction. In such a case, there will be no entry in the matrix tables for a transaction between A and C).

Four kinds of direct measurements transactions matrices have been developed. The basic type is the specialized supplier-user matrix developed by each microstudy, using the supplier and user categories meaningful for the particular field of measurement. These matrices have been published as part of the reports of the individual microstudies, and are not reproduced here. The other three types of matrices are presented here and use standardized supplier-user categories.

The first is a supplier-user matrix for a given field of measurement, using standardized supplier-user categories. The second displays all of the inputs into a given user sector, from the array of standard supplier sectors, for each of the defined microstudy measurement sectors. The third shows all of the outputs of a given standard supplier sector, for all of the microstudy measurement sectors, to each of the standard user sectors.

The supplier and user sector lists have been defined so that they are identical; that is, every supplier is entered as a user, and *vice-versa*. This approach reflects the facts that a major user sector may be its own primary supplier of measurement results, and that the primary supplier sectors are users of measurement needs information provided by the primary user sectors.

The significance of the intra-sector transactions needs emphasis: The matrix elements in which the supplier of measurement goods and services is also the user of those goods and services include the vast bulk of the measurements made in our society: those made by the individuals or organizations using them.

The supplier-user sectors have been defined so that all of the structural-institutional elements of the national measurement system are accounted for. The governmental user sectors have been defined pragmatically. The industrial and commercial sectors have been defined by use of SIC (Standard Industrial Classification) codes, as given by the *1972 Standard Industrial Classification Manual* (Executive Office of the President, Office of Management and Budget, published by U. S. Government Printing Office, 1972).

The use of SIC codes has been straightforward, with a few exceptions. SIC major group 39, Miscellaneous Manufacturing Industries, is mostly not explicitly accounted for; the ground rule here has been to include specific group 39 activities with that

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF NBS — USERS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY	2 3	3 4 1 2		3 3	3 4	3 3	3 2 1 2	3 3	3 3	3 4 ?	3 3	1		4 4						1 1	1	3 4 1	1		2 3
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 1	3 1 3	2 2 1 2	3 1 3	2 1 3		3 1 1 N	3 1 4		1	1		1	4 1 4 2	1		3 1 3	3 1 4	3 1 4	1 3 2	3 1 3	1	3 1 N		1 1 1
3 VIBRATION & SHOCK	3 2 2	2 3 1 2	2 2 2 2	2 2 2	2 1 2			2 1 2	1	3 1 N	2 1 2								2 3 1	2 3 1	3 2 2 1	2 2 1			2 3 1
4 SURFACE FINISH	3 1 2 2	3 2 2	3 1 2 2	2 1 2	3 1 2			3 1 2		3 1 2	2 1		3 1 2			3 2 1 2	2 2 1	2 1 2	2 1 2	3 2 2	2 1 2			2 2 2
5 MASS, VOLUME & DENSITY	4 1 4	4 1 4 3	2 1 3	2 2 1	4 2 3		4 1 4 2	2 2	3 1 3	1 2 N	2 1		2 1 1	2 2 1		2 1	2 2 1	2 1	2 1 1					1 2 N	
6 FORCE	2 3 2	2 4	2 3 2	3 3	2 4		1 1	3 3	3 3 2	1 4 N	2 4 2	2 3	1 2	1 1	1 1	1 2	1 2	1 2	1 3	1 2	1 2	1 2	1 2		1 1
7 FLUID FLOW	2 1 3 2		2	3	3 1 3 2			3 3	3 3	3 3	3	2 1 2	2	2 2	2 1 2		2 2			2 1 2	2 1 3		2 1	2 1 1
8 PRESSURE	3 2 1	3 2 1 1	3 2 2	3 4 4	4 3		1 .	3 1 2	3 2	3 3	4 3 2 1		2 1 2 1	1	1	2 1 1	2 1 3 1	1	2 2	3 4 1	4 1 4 1	4 1 4 1	1	3 1 1
9 TEMPERATURE	3 3 3	4 3 2	2 1 3 2	2 3 2	2 3 3		2 1 2	2 3 2	2 2	2 3	2 3 3		2 1 2	2 1 2		2 1 2	2 1 3 2	2 1 3 2	2 1 2	2 1 2	2 1 2	2 1 2	2 1 2	1 1 1
10 HUMIDITY & MOISTURE	2 1 2		2 3 2	3 1 3	2 1 2		3 3 2	3 1 3		3 1 3	2 2 3	1		3 3 2		3 3 2	2 2 1	2	2 1 2	2 2 1	3 1 2			1	1
11 THERMODYNAMIC PROPERTIES OF FLUIDS	4 2 3 1	4 1 3 2	4 2 3 1	3 1 3 2	4 1 3 1			3 1 2 2	2 2 2 3	3 1 4 1	3 2 4 3	3 1 2 2	2 2 3	2 3 1 2		X	2 3 1 3	1 1 2	2 1 2	1 2	2 1 2	2 2			
12 CRYOGENICS	4 1 4	4 1 4 2	3 1 3 2	4 1 4 2	3 2 1 2		3 1 2 2	2 1 2	2 1 2	3 1 4 2	2 1 4 2	2 1 2	2 1 4				2 1 3 2			2 1 3 2	2 1 3 1		1 2 1 2
13 ELECTRICITY	3 2 3	3 1 3 2	2 1 3 3	4 1 4 3	4 1 4 3		1	3 2 4 2	3 1 3 2	2 2 2 2	3 1 3 2	3 1 2 2	1 1 2				3 1 1 2	3 1 2	1	3 1 3 2	3 1 4 1		2 1 2 2		
14 ELECTROMAGNETICS	3 2 4 2	3 2 3 1	2 2 1 2	3 2 4 1	3 1 4 1			3 2 4 1	3 2 2 1	1 1 3 1	3 2 3 1		2 2 1 1						1	3 2 3 1	4 3 3		1		
15 MEDICAL ULTRASONICS	3 2 3	2 2 4	2 2 2 3	2 3 2	2 1 1				3 1 2		1 .		2 1 2 1										3 2 1 2		
16 ACOUSTICS	2 2 3 N		2 1 3 1	2 1 3 4	2 1 2			2 1 3 1	3 3 1 2	2 1	2 3	2	3 2 3 1		2		1			2 1 2	2 3 1 2		2	
17 RADIOMETRY & PHOTOMETRY	3 1 4 2	3 1 3 2	2 2 3 2	3 1 4 2	4 1 3 2			4 1 4 2	4 2 2 2	2 1 2 N	3 1 2 2		2 1 4 2		1					3 1 4 2				3 1 2
18 SPECTROPHOTOMETRY	2	X	1 3 2	1 3 2	1 1 2			2 2 2 2	2 1 2 2	1 1 1	2 3 2 2	1 1 2	2 2 4			2 3 2 2	2 3 2 2			2 3 2 2	2 3 2 2	2 3 2 2	2 3 2 2	2 1 2 2	
19 FAR ULTRAVIOLET RADIOMETRY	2 3 1	2 3 2	?	2 2 2	4 2 2			2 2 2 2	2 3 2 3	2 2 1	3 2 3					2 2 1 2	2 2 4			2 3 1 4			2 2 1 4		
20 OPTICS	2 1 2		2 2 1	3 1 3	3 1 2	1 1 N		4 3	3 1 1	4 3	4 1 2	1 1			2 1 2		1	4 4	4 2	4 4	2 1 3	2 1 1	1 1		
21 LASERS	4 3	4 2	4 3	4 2 4	4			2	4 4	4 4	4 4	1 3 1	1							4 2 4	4 2 3	3	3		
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	3 4 3			2 2 2	3 4 4					3 4 2	3 1 3 2						3 3 3			3 4 2					
23 SURFACE PROPERTIES	4 3 2	1	3 2 2	1 3 2 2	3 2 3 2			2 2 1 2		3 2 3 2	3 2 2						3 2 3 2	2 3		3 2 3 3 2					
24 IONIZING RADIATION	2 1 3	3 2 4 2	3 3 4 3	3 1 4	4			3 3 3 2	3 4 3	3 4 3 2	4 3 4 4	4 3	2 2 3 2			2 2 1	2 4 4	4 2		2 4		4 3 4 4	4 3 3	4 3 4 2	1 1
25 AVERAGE	3 1 3 1	3 1 3 2	3 1 3 2	3 1 3 2	3 1 4 1	3 1 1	4 1 2 2	3 1 3 1	3 2 2 1	3 3	3 1 3 2	2 1 1	2 1 2	4 1 2 1	1	2 2 1 1	2 2 2 2	4 2 2 2	2 1 2 1	3 1 2 1	4 1 2 1	4 2 2 2	4 3 2 2	4 3 2 2	2 1 1

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C - IMPORTANCE OF TRANSACTIONS

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1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

R = Flow of requirements info dominates

? = Unknown, X = Not studied, Blank = 0

non-miscellaneous group that was most similar technically. Similarly, Division I, Services, includes health services, educational services, and membership organizations that fall under other specific supplier-user sectors in these matrices, so that the standard sector that includes "personal services" includes only those portions of Division I not otherwise accounted for. Further, major group 27, Printing and Publishing, is closely related technically to a number of the activities remaining in Division I, and is therefore grouped with them. Finally, SIC Division J, Public Administration, has been omitted as such, since it is covered by the various governmental sectors of the matrix, and the SIC codes do not correlate easily with the governmental sector definitions found useful here; in addition, the U. S. Postal Service has been handled as a governmental entity, not as part of SIC Division E.

The specific definitions of the supplier and user sectors are given in connection with the Input and Output tables for these sectors. Abbreviated definitions are given below:

The primary supplier sectors are the following:

Sector 1. The Knowledge Community
Sector 2. International Metrological Organizations
Sector 3. Documentary Standardization Organizations
Sector 4. Instrumentation Industry (SIC 38)
Sector 5. NBS
Sector 6. Other U. S. National Standards Authorities
Sector 7. State and Local Offices of Weights and Measures
Sector 8. Standards and Testing Laboratories and Services
Sector 9. Regulatory Agencies (excluding offices of weights and measures)
Sector 13. Industrial Trade Associations.

The primary user sectors are:

Sector 1. Knowledge Community
Sector 4. Instrumentation Industry
Sector 9. Regulatory Agencies (excluding standards laboratories)
Sector 10. Department of Defense (excluding standards laboratories)
Sector 11. Civilian Federal Government Agencies (excluding standards laboratories and regulatory agencies).
Sector 12. State and Local Government Agencies (excluding office of weights and measures and regulatory agencies)
Sector 13. Industrial Trade Associations
Sector 14. Agriculture, Forestry, Fishing; Mining (SIC Divisions A & B)
Sector 15. Construction (SIC Division C)
Sector 16. Food, Tobacco, Textiles, Apparel, Lumber, Furniture, Paper, Leather (SIC 20-26, 31)
Sector 17. Chemicals, Petroleum, Rubber, Plastics, Stone, Clay, Glass, (SIC 28-30, 32)
Sector 18. Primary and Fabricated Metal Products (SIC 33-34, 391)
Sector 19. Machinery, except Electrical (SIC 35)
Sector 20. Electric and Electronic Equipment (SIC 36)
Sector 21. Transportation Equipment (SIC 37)
Sector 22. Transportation and Public Utilities (SIC Division E)
Sector 23. Trade, Retail and Wholesale; Insurance, Finance, Real Estate; Personal Services; Printing and Publishing (SIC Divisions F-H, balance of Division I, and Major Group 27)
Sector 24. Health Services (SIC 80)
Sector 25. General Public

3. MATRIX DATA ENTRIES

The data entered into these matrices is the following:

(1) In the center of each transactions box a number is entered to define the magnitude of the transactions that occur between the given supplier and user, i.e., *how much* happens. "How important," "how well," and all other questions are ignored.

For the individual measurement sector matrices, a code number from 0-4 has been used to define this magnitude factor. NBS budgetary data were used to provide a semi-quantitative basis for some of the transactions involving NBS. Primarily, however, the coding was done on the basis of experienced judgment, only.

In the case of the matrix rows or columns for the system as a whole, summed over all of the measurement sectors, quantitative data were available to provide a basis for some of the judgments. Specifically, data were available for 1963 with respect to the transactions of the instrumentation industry with the other SIC sectors, and for the magnitude of the measurement-related activities within the SIC major group sectors. The detail available was not always adequate for an unambiguous judgment. For instance, there is no simple way to estimate how much of the measurement-related activity in the retail and wholesale trade sector represents the development of data that is consumed within the sector versus the provision of measurement information to an ultimate customer, the general public. Partitioning the total dollar amount of such activity was done on an intuitive basis.

The correlation table used for connecting dollar levels of expenditures with the magnitude entries for the summary rows and columns is the following:

Code No.	1963 $ Range
7	3-10 billion
6	1-3 billion
5	0.3-1 billion
4	100-300 million
3	30-100 million
2	10-30 million
1	less than 10 million
0	negligibly small

Caution should be used in equating a given magnitude code number for an individual measurement sector with a magnitude code for the summary rows and columns. Generally speaking, there may be a factor of ten or more difference in the dollar ranges assigned to a given code number at the measurement sector level and the values assigned at the total system level.

Comparisons within a measurement sector can be made with a fair degree of reliability, and comparisons between measurement sectors are only slightly less reliable. However, the precision of assigning these magnitude code numbers is never very high, so that there is perhaps one chance out of three that any given code number is in error by one unit, either too high or too low. Thus, differences by one unit between magnitude codes assigned to two different boxes may or may not be significant. On the other hand, the probability that the overall pattern is grossly wrong is relatively small.

Normally, zeros have been suppressed or omitted from these tables, to reduce clutter. Therefore, a blank intersection box means that a specific judgment has been made that the magnitude of the transactions for that box is trivial or negligible. If the magnitude is unknown or significantly in doubt, a question mark (?) is entered in the box. If no attempt has been made to estimate the magnitude at all, an "X" is entered.

If the only numerical entry in a given transaction box is the central magnitude number, that indicates that no attempt has been made to provide a numerical code for any of the other attributes of the transactions, as described below. It does not mean that all of the other codes have been estimated to be zero, and the zeros suppressed.

(2) If any additional judgments have been made about the nature of the transactions for a given intersection box, a number from 1 to 4 will be entered in the upper left hand corner of the box. This code number characterizes the importance or criticality of the transactions, independent of their physical volume, a low number denoting transactions of low inherent importance, a high number indicating transactions that are critically important, even though perhaps low in volume. Note that if any entry at all has been made in the upper left hand corner of the box, then judgments have also been made about the following two aspects, and a blank space for them means a suppressed zero.

(3) The lower left hand corner of the box is used to code the rate of change of the magnitude of the transactions for that intersection, from "N" for a negative rate of change to zero for a stable situation to a positive number (1-4) for a growth situation.

(4) The degree of (in)adequacy of the transactions in terms of providing the goods or services needed or desired by the user is coded into the upper right hand corner of the box. A zero indicates a situation thoroughly under control, a four indicates one substantially out of control.

(5) The lower right hand corner of the box has been used to indicate those transactions situations that substantially involve only flows of information about needs, requirements, or regulations. An "R" entered in this corner implies "requirements" or "regulations", and indicates that little flows in the way of measurement data, goods, or services. "R's" will often be found for the supplier-user transactions connecting sectors that are normally users of measurements to sectors that are normally suppliers.

4. DEVELOPMENT OF THE MATRICES

The direct measurements transactions matrices were developed in an iterative fashion.

The initial matrix for any measurement sector was developed by the author(s) of the microstudy in that sector. The overall study coordinator (the present writer) then reviewed the initial draft matrices and made suggestions to the authors to improve consistency in the application of definitions and the general validity of the matrices. This input was used by the authors in revision of their matrices, to generate the transactions matrices published in the various microstudy reports. The supplier-user sectors defined for these reports were standardized with respect to certain specific institutional/structural elements of the system, but most of the end-user categories were left for the microstudy authors to define in whatever fashion would be most useful for their studies. Use of SIC codes was encouraged, but was generally not practiced and not particularly useful.

The present writer then faced the task of translating all of these specialized matrices into a standard format that would allow intercomparison. The main problem arose in the industrial and commercial sectors, where it

soon became obvious that only a rather rigorous use of SIC codes would be effective. However, to keep the matrices to a manageable size and to make them significantly useful, it was necessary to group the SIC codes creatively, not purely mechanically. This was done, to produce the groupings described both above and below in connection with the matrix charts themselves.

The specialized supplier-user matrices were then "translated" into the standardized supplier-user category formats, and copies of the resulting first draft standardized matrices were given to the original authors, so that they could suggest whatever revisions they thought appropriate. Several made significant changes, or even adopted the standardized categories for use within their own studies.

The next step was to generate from the 24 different standardized supplier-user matrices (for the 24 different measurement sectors for which microstudies were conducted) "rotated" matrices to describe all of the inputs to a given user sector, from each of the supplier sectors, for each of the measurement sectors, and the similar matrices that described all of the outputs for a given supplier sector.

These "rotated" matrices were then examined to determine their degree of *a-priori* intuitive completeness (e.g., was there an entry for pressure measurements being made and used in the Health Services sector?) and consistency (e.g., is the magnitude estimated for temperature measurements in the Health Services sector compatible with the magnitude estimated for pressure measurements?). As a result of such examinations, many additions and revisions of entries were made. (It should be noted that these changes did not necessarily imply any errors or omissions on the part of the original authors, or any intent to override their judgments. Often, they merely were compensating for arbitrary decisions made in the initial process of translating from the specialized supplier-user categories to the standardized categories.) These revised entries were then transferred back onto the original translated matrices, and the results again reviewed for completeness and consistency.

The "rotated" matrices were also used to generate the rows and columns of a master summary matrix describing the direct measurements transactions of the national system of physical measurements. Summing up the entries for 24 different measurement sectors to deduce an entry for the summary transactions box was a further exercise in intuitive judgment. Arbitrary decisions were made, such as saying that all measurement sectors are of equal importance, except that sometimes it is obvious that some enter into the summation more significantly than others. Similarly, any row or column with an excessive number of "4" level magnitude entries in it was arbitrarily given a "4" or higher magnitude entry in the summation. Any row or column with at least one "4" level magnitude entry in it could receive no lower than a "2" level entry in the summation. Numerical summation and averaging was used, both on a linear basis and on a square-root-of-the-sums-of-the-squares basis. A stretched scale was used to correlate the resulting averages with the final digital numerical entries, to avoid the tendency of such approaches to compress all of the data into a small average region. Whenever application of these rules tended to produce results that appeared anomalous, all relevant matrix entries were reexamined, and sometimes changed.

The next to the last step involved publication of a preliminary version of this report out to the microstudy authors and other senior individuals within the Bureau, to obtain their critique of the results generated by the processes described above. The results of this critique were then used to produce revised versions of the individual supplier-user-measurement sector transactions boxes, and a final review was made of the summation for the master summary matrix, to produce the matrices published in the final version of this report.

5. THE DIRECT MEASUREMENTS TRANSACTIONS MATRICES

On the following pages we present the direct measurements transactions matrices resulting from the 1972-75 study of the National Measurement System by the NBS Institute for Basic Standards. The matrices for the 24 different measurement sectors come first, followed by the input and output matrices for the individual supplier-user sectors. The master summary matrix of the transactions in the national system for physical measurements has already been presented on page 2. Descriptions and commentary on the makeup of the various supplier-user sectors accompanies the input and output charts for those sectors. Keys to the code entries are presented with each measurement sector chart and for each of the pairs of input and output matrix charts, so that any selective copying of the tables is likely always to include a copy of this key. The Outputs matrix for NBS has been presented on both pages 4 and 41.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR TIME & FREQUENCY — SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4	3		2	2 3	3		2	1	3	3										2	1	2			
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1	3		3	3 1 3	3 1 3		1	2	2	2			4 1 3									4 1 4			
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS																										
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	2 1 2		3 3	3 1 3	3 1 2	1	3 1 3 2	2	3 2 4 2	3	1		3 3	1	2	2	2	2	3	2	2 1 4 2	4	2	4
5 NBS	2 3	3 1 4 2		3 1 3	3 1 4	3 1 3	3 1 2 2	3 1 3	3 3	3 ? 4 ?	3 3	1		4 4						1	1	3 1 4	3		2 3
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2	3 3		2 2	3 1 3	3 2		2	2	4 ? 4 ?	2			4								4			1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)				1 R	3 1 2 1 R	1 R	2		1			1										2	1		1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1			2 ? 3 ? R	2 1 2 R	1 R		4	1	3 ? 4 ?	3						1	1	1	3	3	2 1 3 2	1		
9 REGULATORY AGENCIES (excl. OWM's)				2 R	3 2 R	1 R	1 R		3	2 R	3 R			2 R						2 R	1 R	3 ? 4 R	1 R		1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2			2 ? 3 ? R	2 1 2 R	3 R		4 R	1	4	1											2 R			
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2			2 R	3 1 2 R	1 R		3 R	1	1	4									3 R	2 R				1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)							2 R		1			2													1
13 INDUSTRIAL TRADE ASSOCIATIONS																									
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & 8)				2 ? 2 ? R	2 1 2 R	1 R		1 R	2					4						2 R					
15 CONSTRUCTION (SIC Div. C)															1										1
16 FOOD/TOB/TEXTILE/ APPAREL/L8R/FURN/PAPER/ LEATHER (SIC 20-26, 31)																3									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)																	3								
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)																		3							
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																1	1	1	2				1		
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1			4	1	1		1	1											3	1	2			1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)				2 R	1 R			1 R	1											1 R	2	1			1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 2			2 1 3 ?	3 1 4 2	3 1 3 2	2	2 1 3	2 ? 3 ?	4	3	2		2	2	3	3	3	2	3	2	3 1 4 2	4	2	3 4
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)				3 R	1 R		1 R	1 R				1										1 R	4	1	4
24 HEALTH SERVICES (SIC Major Gp 80)				1 R																			1 R	3	2
25 GENERAL PUBLIC				2 ? 4 ? R	2 1 2 R	1 R	1 R					1 R								1 R		2 ? 3 R	3 R		4

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR LENGTH & RELATED DIMENSIONAL MEASUREMENTS — USERS / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds. Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3	2	1	2	2			1		3	4				1				1	2	1		2	1	1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1	3	2 1 / 1	2 1 / 1	3 1 / 2																				
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	1 1	2 1	3	2 1 / 2	2 1 / 2		3 1 / 1	3 1 / 3		2	2		2	2 1 / 1	2	1	1	2 1 / 4	2 1 / 4	2 1 / 3	2 1 / 3	1	1	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	1 1 / 2	2 1 / 1	2 1 / 1	3	3 1 / 2		1 1 / 2	2 1 / 2		4	3	2	2	2	4	3	2	2 1 / 3	2 1 / 4	2 1 / 3	2 1 / 4	2	2 1 / 1	1	3
5 NBS	1 1 / 1	3 1 / 4	1 3 / 2 / 2	1 3 / 3	2 1 / 3		3 1 / 1 / N	1 / 4		1	1		3	4 1 / 4 / 2	1		3 1 / 3	3 1 / 4	3 1 / 4	3 1 / 3 / 2	3 1 / 3 / N	1	3 1 / 1 / N		1 1 / 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)			2 / 1	1 2 / 2	1 2 / 1 / R		2 1 / 2	2 2 / 2				1											3 2 / 3		3 1 / 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1 1 / 1	2 / 2	1 2 / 2	1 2 / 2 / R	3 2 / 2 / R		2 2 / 1	2 2 / 2		3	2	1			1		1	2 1 / 1	2 1 / 2	2 1 / 2	2 1 / 3		1		
9 REGULATORY AGENCIES (excl. OWM's)																									
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	1		2	3 / R				3 / R		4					1 / R			2 / R	4 / R	3 / R	4 / R	1 / R	1 / R	1 / R	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1		2	2 / R	1 / R			1 / R		1	4	3		1	2			1 / R		2 / R	3 / R	3	1 / R	1 / R	2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)				1 / R			2 / R			1	1	4		2	4				1 / R		1 / R	2	1 / R		2
13 INDUSTRIAL TRADE ASSOCIATIONS		2	3	3 / R	3			1		1			3	3	1		3	3	3		2				
14 AGRICULTURE, FOREST, FISHING; MINING (SIC Div. A & B)			2 / 2	1 2 / 2 / R	3 1 / 2 / R						1	1	3 / R	2 1 / 3	1	1		2 / R	2 1 / 3 / R		1 / R				
15 CONSTRUCTION (SIC Div. C)			1	1 / R						1	1	3		1	4			1 / R	1 / R				1 / R		3
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER LEATHER (SIC 20-26, 31)					1 / R										2	4			2 / R				2		4
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					2 1 / R								3 / R		2		1 3	2 1 / R					1		2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	1 1 / 1		2 / 3	1 2 / 2 / R	3 1 / 2 / R					1			2	2 1 / 4	1		1	1 4	2 1 / 3	2 / 2	2 1 / 3	1	1		1
19 MACHINERY, EXCEPT ELECTRICAL SIC Major Gp 35	1 / 2		2 / 2	1 2 / 3 / R	3 1 / 3 / R			2 1 / 1 / R		3	2	2	2	2 1 / 4	2	2	2	1 3 / 4	2 / 4	2 1 / 3	1 2 / 4	1			1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)			2 / 1	1 2 / 2 / R	3 1 / 3 / 2 R			2 1 / 2 / R		1	1							1	2 1 / 2	1 1 / 3	2 1 / 2	1	1		1 1 / 1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1 1 / 1		2 / 2	1 2 / 3 / R	2 1 / 2 / R			2 1 / 3 / R		3	2	1	1		1		1	2 1 / 2 / R	2 1 / 2 / R	1 / P	1 4 / P	3	2		3
22 TRANSPORTATION & PUBLIC UTILITIES SIC Div. E)				1 / R			1 / R			1	2	2									2 / R	4	2		2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)	2 1 / 1			2 1 / 1 / R	2 1 / 1 / R		2 1 / 2 / R			1	1	1		1	1	2 / R	1 / R	1 / R			1 / R	1	2 1 / 4	1	2 1 / 4
24 HEALTH SERVICES (SIC Major Gp 80)	1			1 / R						1	1										1 / P	2	2		2
25 GENERAL PUBLIC	1 / P			1 / P	1 / P		1 / R				1 / R	2 / R			1 / R	1 / R	1 / R	1 / R	1 / P	1 / R	1 / P	1	2 1 / 3 / P	1	1 1 / 4

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

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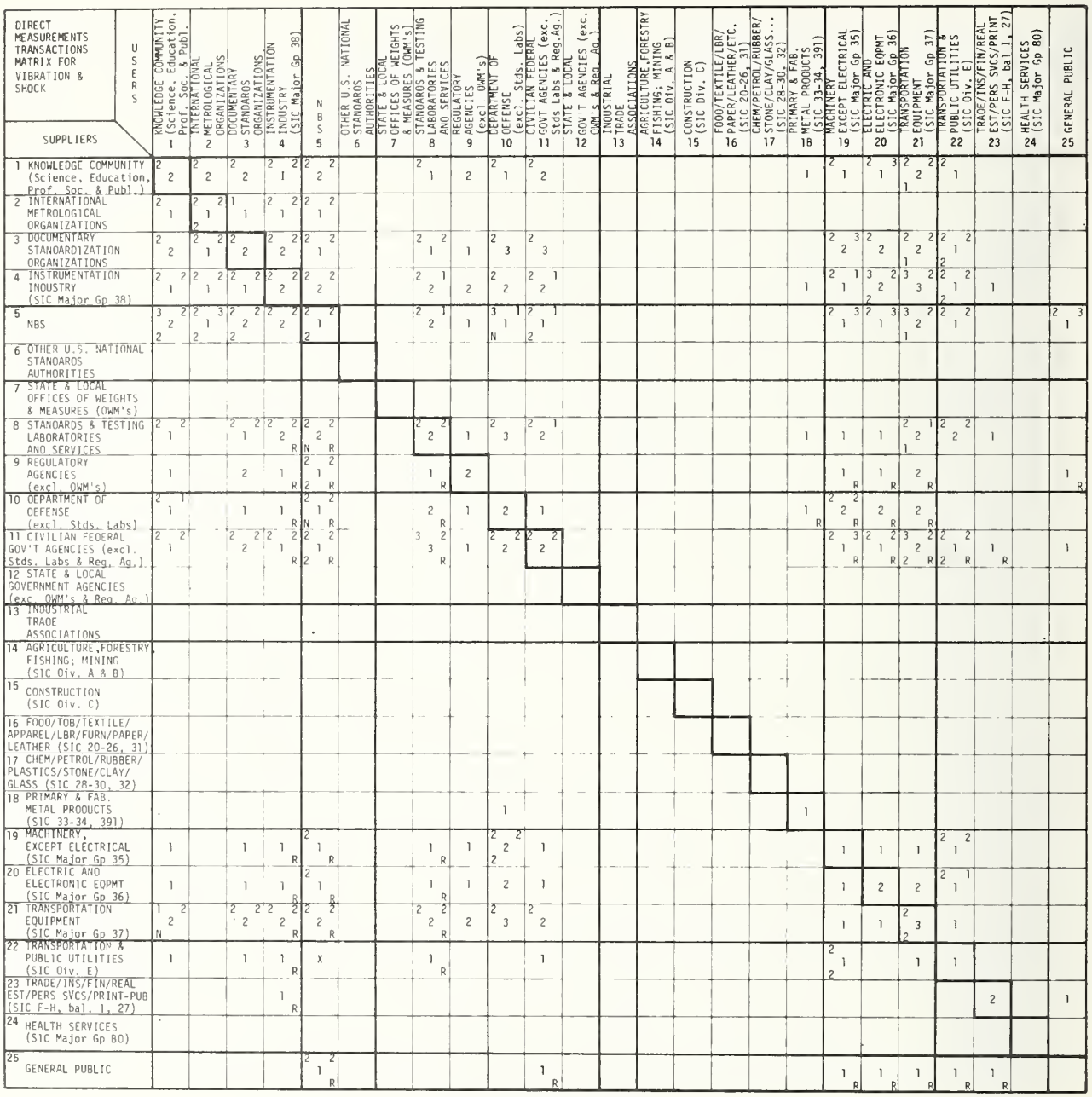

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR SURFACE FINISH — USES / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING,MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4 2 3 2	4 2 2	4 3 3 2	4 3 3 2	4 1 3 2			2 2 2		2 3 2	2 3 2		2 3 3 2			2 3 2 2	3 2 2	2 3 2	2 2 2	3 1 3 2	3 2 3			3 1 3	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	2 1 1	3 2 3	3 1 3 2	3 2 2 2	3 1 2 2					1			2					1							
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	2 1 2 2	3 2 3 2	4 2 3 2	4 2 3 2	4 2 3 2			3 2 3		3 2 3	3 1 2		3 2 3			3 3 2 2	3 2 2	3 2 2	3 2 3	3 1 3	3 1 3			3 3 3	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 2 3	3 2 1 2	4 2 2	3 3 2	3 1 2 2			2 1 2		2 1 2	2 1 2		3 1 3			2 2 1	2 2 1	2 2 1	2 1 3	3 1 3	3 1 3			?	
5 NBS	3 1 2 2	3 2 2	3 1 3 2	2 1 2 2	3 1 2			3 1 2		3 1 2	2 1 1		3 1 2 2			3 2 1 2	2 2 1	2 2 1	2 1 2	3 2 2 1	2 1 2 2			2 2 2	
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1 1 1		3 1 3	2 2 R	4 1 3 2 R			3 1 2		3 3	2 1 2		3 1 3			1	1	2 1 2	2 1 2	3 1 3	3 1 3		1		
9 REGULATORY AGENCIES (excl. OWM's)																									
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 2		3 3	3 3 R	3 1 2 R			3 1 2 R		3 3	2 2		3 3 R					3 3 R	3 3 R	2 2 R	2 2 R				
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 3		3 3 2	1 2 R	3 1 3 2 R					2 2	3 1 3		2 1 2 R			2 2		3 2	3 2				1 R		
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																									
13 INDUSTRIAL TRADE ASSOCIATIONS	3 3		3 3	2 3	3 1 3 2 R			2 1 2 R		3 2 R	2 2		3 3			4 3 2	2 2 2	4 3	4 4	3 1 3	3 3			2 1 2	
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)																									
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 2D-26, 31)	3 3 2 2		4 2 3 2 2 R	3 2 2 R	4 1 2 R			?		?	4 1 2 R		4 1 4 2 R			4 1 2		4 1 3 R	4 1 3 R	3 1 2 R	1 R				3 1 1
17 CHEM/PETRDL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1		2 1 2	1 R	2 1 1 R					3 2 2 R							3 1 3		1 R					3 1 2	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	2 1 3		4 3	3 3 R	3 2 2 R			1 R		3 3	4 1 2		4 4			3 1 3		3 4	3 1 3	3 3	4 4			3 1 3	3 1 2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	2 1 3		4 3	3 3 R	3 2 2 R			1 R		3 3	4 1 3		4 4			3 1 3		3 3 R	3 1 4 R	3 4	3 3	4 4			3 1 1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	4 1 4 2		4 1 4 2	3 2 3 R	3 1 2 2 R			4 4 2 R		4 3 2	2		4 4			1		4 2 1 R	4 2 2	3 2 3 2	3 2			4 1	
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	3 3 2		3 2 2 3	1 2 R	3 3 1 R			2 R		1	1		2 1 3			1		3 3 R	3 1 2 R	1	3 3 2				1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)																									
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)																						1			1
24 HEALTH SERVICES (SIC Major Gp 80)	3 3 2		3 2 2 2	2 2 R	3 2 2 R								2 2 3 R			2 2 1 R			1 R				3 3 1 2		
25 GENERAL PUBLIC																	3 1 R	3 2 R	3 1 R	3 2 R	3 2 R		2 R		

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR MASS, VOLUME, & DENSITY — SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS,.. (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	1 2	3 2 1 2	2 3 1 2	2 2 N 2	4 1 3 2			1	2 1 2	2 2 3 N	1			1			2 1		2 2 1				2 1 1 2	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1	4 3 2	3 3 2	2 4 2 4	3 2 3 4		2 4 1 4												2 4 2 4					
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS	1	3 1 4 2	2 2 2	3 1 3 2	2 3 3		3 1 2	4 3	1	1 1 1	1		1	X		2 1	2 1		3 1 3 2		1	1	2	2 1	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	1 2	2 2 1 3	2 1 2	1 3	2 1 3 2		2 1 2	2 3 2	2 2 2	2 2 2	1 2	1		1 1		2 3 2	2 2 2	1	2	1	2	1 .	3 1	3 3	2
5 NBS	4 1 4	4 1 4 3	2 1 3	2 1 2 1	4 2 3		4 1 4 2	2 2	3 1 3	1 2 N	2 1		2 1 1	2 2 1		2 1	2 2 1	1	2 1 1					1 2 N	
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)		2 2 1 1	2 1 2	3 1 2 R	4 1 4 R		4 3	2 1 2	1	1		3 1 1		2	1	3 1 4 2	1		3 1 3 2 R		1	3	4 4 1		4 1 3 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES			1 1	1 2 R	2 2 R			2 2		3	1 3	1		1			1 2		1 R	1	1		I	2 2 1	
9 REGULATORY AGENCIES (excl. OWM's)			1	1 R				1 R	3				1 R	1 R		3 1 1 R	3 1 2 R	1 R	1 R		3 1 2 1 R	3 I 3 1 R	2 R	3 1 2 1 R	1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	1		1	1 2 N R			1 3 R	3 R		1							1 R	1 R	2 1 N	1 R		1 R	1 R	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 1 1 N	2 2 2	1	2 1 R	2 2 R			3 R			1 3	1 R			1 R	1 R	1 R	1 R	2 1	1 R		1 R	1 R	1 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)							2 1 R	1 R				3			1 R			1 R	1	1 R		1 R	1 R	
13 INDUSTRIAL TRADE ASSOCIATIONS		2 2 1 2	2 1 3		2 1 2 R			2 1 2 R	2 2 3 1				1 2 1			2			3				3	1
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	1		2 2		3 1 R		2 1 R R	1 R				1	2 1	2 4	1 R	4	4	4	1 R		1 R	4 R	2		1
15 CONSTRUCTION (SIC Div. C)				1 R			1 1 R R	1 R		1	1	2		1	3	1	1	1 R				2	1		
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)			1	1 R			4 R	2 1 R	2 1	1	1		2 1	3		4			2 R			1	2 3	1	3
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1	2 2 1 2	2 2	1 R	3 2 1 R			2 R	1	2	1		2 1	3	3	1	2 4	1 R	1 R	1	1 R	2	1	3	2
18 PRIMARY & FAB METAL PRODUCTS (SIC 33-34, 391)			1				1	1 R	1	2	1	1		1	1	1	1	3	1			1	2		1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1	2	3	3	3 R		2	2	1	2	2	1		1	2	2	2	1	3	1	2	4	4	2	4
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)								1 R												2					1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)			2 2					1	2 2 R 2	1	1	1	2 1 1 R	1	1		1		1 R		2	2 2 1	1		1 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)			1	1 R			3 R		2	1	1	2		4	2	2	2	2	2	1	2 3	2 4	2 3	1	2 1 3
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)			2	3 R			4 R		1	1	1	2	3 R	2	2 R	4 R	1 R	1	3 R	1	1	2	4	1	4 2 4 1
24 HEALTH SERVICES (SIC Major Gp 80)	1			2 2					3 1 2 1	1	2 1 1						1 R						2 R	4	4 2 1
25 GENERAL PUBLIC				I R			3 1 1 R		3 1 2 1 R			1 R	1 R	1 R				1 R	1 R	1 R	1 R	1 2 R	1 4 1 R	1 1	1 4 1

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1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3	1	2	2	2 3			1	1	2	2				1	1	1	3	3	1	3				
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS		4 3	3	1	4 3														2						
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	1	2 3	3	3 2	3 3 2		1	3 3	3 3	2 3	2 3	3 2 2 2	3 4 2 R	3 2 2	3 2 2	3 4 2	3 3 2	3 4 2	3 4 2	3 2 2	3 3 2	3 3 2		4 2 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	1	2 2	2 3 1	1 2			1 2	2 2	1 2	1 2	1 2	7	3 1	3 1	2 3	2 2	2 3	2 3 1	2 2	2 2	2 1	1	2 1
5 NBS	2 3 2	2 4	2 3 2	3 3	2 4		1 1	3 3	3 3 2	1 4 N	2 4 2	2 3	1 2	1 1	1 1	1 2	1 2	1 2	1 3	1 2	1 2	1 2		I 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																								
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)		1	1		1 R		2	4 2	2 1	1		3 2	2 2	2 3	2 1	1 1	1 1		3 3		1 1	1 2	3 4		1 2
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 2		2 3 2	3 2 R	1 2 R			2 3	2 3 2	3 4	3 4	2 2	1 2	3 3	3 3	2 3	2 3	2 4	2 3	2 3	2 4	2 2	3 2		
9 REGULATORY AGENCIES (excl. OWM's)	1		3 4 2 2	2 ? 2 ? R	2 2 4 2 R		1	3 2 3 R 2 R	2	3 2 R	3 3 R	2 R	3 2 2 R	3 1 2 R	3 1 2 R	3 1 1 2 R	3 1 1 2 R	3 2 2 R	2 3 R	2 3 R	3 4 2 R	4 2 R	3 4 2 R	
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 2 2		2 3 2	3 2 R	2 4 R			2 4 R	1	3 4	2 3					2 1 R	2 1 R	2 2 R	2 3 R	2 2 R	3 R	2 3 R	4 R		
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 2 2		2 4 2	2 R	2 4 R			2 3 R 2	2 4	2 2	2 4	2 4			2 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R		1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)			1	1 R	2 2 R		2 R	3 3 R	1		2	3 ? 3 2	3 ? 2 2						1 R					
13 INDUSTRIAL TRADE ASSOCIATIONS			2 2 4 ? 2		2 2 R		1 R	3 3 R 2	2 ? 3			2 ? 2 2 R	2			2			3			3		I
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)			2 1					2 2 R	2 1	1 ? 1 ?		?	2 1	2 4	2 2	3	3	2	2		1	2 3	2	3 1 2
15 CONSTRUCTION (SIC Div. C)			2 1	1 R	2 1 R			2 2 R	2 1	1 ? 1 ? ?	2 ? 1 ?	?	2 2	2 1	2 3	1	1	1	1		1	2 2		3 1 2
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)	2 2		2 3	3 R	1 2 R			2 3 R	2 1	2 3	2 1	?	2 3	2 3		2 4			2 R			2 2	2 3		2 1 2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	2 2		2 2	2 R	1 2 R			2 3 R	2 1	2 2	2 1	?	2 2	2 3	2 3		2 4		1 R			2 1	2 2		2 2 2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	2 2		2 3	3 R	1 2 R			2 3 R	2 2	2 1	2 2	?	2 3	2 3	2 3			2 4	2 3	2 2	3 2	3 3	2 2		2 3 2
19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	1 2	2	2 3	2 3 1	2 3 R		2 2	2 3 R	2 2	2 3	2 3	1 3	2 3	2 1	2 2	2 4	2 3	2 3	2 3	2 2	2 3	2 4	2 4	3	2 4
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1 1		2 1	1 R	2 1 R			2 2 R	2 1	2 1	2 2	? ?	2 1	2 3					2 2	2		2 2	2 I		2 I
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 2		2 3	2 R	2 2 R			2 3 R 2	2 2	2 2	2 2	3 3	3 3	2 2				1 1	1 1	1 1	4	2 2	2 1		2 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 2		2 2		2 R			1 R 2	2 2	2 1	2 3	2 3	3 3	2				1 1	1 2	1 1	2	2 4	2 3		2 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)			2 2	1 R	1 R		3 R	2 1 R	2 2	2 1	2 2	2 2	2 3	1 2	1 2	?	?	?	2 3 R	2 1			2 4	I	2 3
24 HEALTH SERVICES (SIC Major Gp 80)				1 P																		1	2	2
25 GENERAL PUBLIC				1 R	1 P								1 R						1 R			2	3	1	3

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
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D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
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3 = Important
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? = Unknown, X = Not studied, Blank = 0

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR FLUID FLOW — USERS / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	1 3		2 4	2 2	4 3			2 2	2 3 2	2	2	2	2	1 2	2 1		1 1 2		1	2 1	2 1 2		2 1 2	1	2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	1		4	3 1 3 2	2 1 2			2 1 2 2	3 2 2	2	2	2	2 1 3 2	2 3	2 1 2		2 3 2		1	2 1 3 2	2 1 3 2				
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 2		2 1 4 2	2 1 4 2	4 1 3			4 1 3	4 2 3 2	2	2	3	2	3 3 2	2 1 4	2	3 3 2	1	1	1	3 1 3 2	3 2 4		1	1
5 NBS	2 1 3 2		2	3	3 1 3 2			3 3	3 3 2	3	3	2 1 2	2	2 2	2 1 2		2 2				2 1 2	2 1 3			2 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1		2	2 1 3 2 R	2 1 3 R			2 1 3	2	3	2	2	1	2 1 3 2	2		2 1 2 2	1	1	2	2 ? 3	2 1 3 2	1		
9 REGULATORY AGENCIES (excl. OWM's)	1		1	2 R	3 1 2 R			2 R	3	1 R	2 R	3 1 2 R	1 R	3 1 2 R	3 1 2 R	1 R	3 1 2 R	1 R	1 R	1 R	3 1 3 R	3 1 4 2 R			1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	4 1 3		2 2	2 R	2 R			3 R	2	4	1	1		1 R	1 R		1 R		1 R		4 R	3 R			
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3		2	2 R	2 R			2 R	2	2	4	2		3	3		1 R		1 R		4 1 4 R	4 1 4 1	1	1	4
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	1		3	2 R				2 R	3	2	1	3 2 3 2		1	2	1	1		1			2			
13 INDUSTRIAL TRADE ASSOCIATIONS	1		3	3 R	2 1 2 R				3		2		2	3	3		3				2	3			
14 AGRICULTURE,FORESTRY, FISHING; MINING (SIC Div. A & B)	1		2 1 3 2	2 R	2 1 2 R			1 R	2	1	2	1	3	4	1		4	1	2 R		2	4			
15 CONSTRUCTION (SIC Div. C)	1		1	1 R	2 1 1 R			1 R	1	2	2	2	3	1	1		1		1 R		1	1			1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)			1	1 R												3									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1		2	1 R				1 R	1					4	1		4		2 R			2	1		
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)														1				1							
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1		1	1 R					1	1	1	1		3	2	1	2		2		2	2	1	1	1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)																				2			1		1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 1 3		1	2 1 3 R	2 1 3 R			2 1 3 R	2 1 3 2	3	2 1 4	2	2	1	1		1		1 R		4	3			1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 1 3		2 1 3 2	2 1 4 R	3 1 3 2 R			2 1 3 R	3 2 4 2	3	2 1 4	3	3	3 2 4 2	1		1		1 R		3 R	3 2 4 2	1		1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)											1								1 R	1 R	1 R	1	1		2
24 HEALTH SERVICES (SIC Major Gp 80)	1			1 R							1													1	
25 GENERAL PUBLIC									2 R		2 R	1 R							1 R		1 R				1

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR PRESSURE USES / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4 4	3 1 2 2	3 3	2 1 3	3 3		1 1	1 2	3 1	3 2	2 3	2 1	2 2			1	2 2	2 2	1 2	3 2 1	3 2 1	2 2			
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 1	4 2	2 1 2	3 2 2	4 2 2																				
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS	1	3 2 2	2 3 1	3 3 2	2 3		1 1	2 1 2	3 2	1	3 1 1	1	2 3	1		1 2	2 1		2 2		3 1 3		2 2 1
4 INSTRUMENTATION INOUSTRY (SIC Major Gp 39)	2 2	4 2 1 1	3 2 1	4 1 4 4	2 2		1	2 3	3 3	2 4	3 2 4 1	2 1 2	2 1 1	3 1 1	3 1 1	3 1 2 1	3 1 4 1	2 1 3 1	3 1 4 1	3 1 4 1	4 1 4 1	4 1 4 1	3	3 1 3	2 1 2 1
5 NBS	3 2 1	3 2 1 1	3 2 2	3 4 4	4 3		1	3 2	3 2	3 3	4 2 1		2 1 1	1	1	2 1 2	2 1 1	1	2 2	3 4 1	4 1 4	4 1 4	1	1	3 1 1
6 OTHER U.S. NATIONAL STANDAROS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					1 1 R																				
8 STANDAROS & TESTING LABORATORIES AND SERVICES	2 1		2 2	2 2 3 R	1 1 R			2		2 3	2 2	1		1	1	1	2 1	1	1	2 2	1	2 2	2 1	?	
9 REGULATORY AGENCIES (excl. OWM's)				3 3 R				2 1 R	2 2		1 R								3 2 R	3 3 R	3 3 R				
10 OEPARTMENT OF OEFENSE (excl. Stds. Labs)	1 1		2 2	2 2 R	2 3 1 R			1 R	?	4 4	1 1										2 1 R	2 1 R			
11 CIVILIAN FEOERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 2		3 2	2 2 R	2 2 R			2 1	?	1	4 4 1 1			2	1						4 3	4 4	1		3 4
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg.Ag.)												1													
13 INDUSTRIAL TRAOE ASSOCIATIONS	1		2	2 3 2 R	2 2 2 R								2 3												
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)			2	3 R										4			2	2 R	2		3	4			
15 CONSTRUCTION (SIC Div. C)			1	1 R											1				1						
16 FOOO/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)			1	2 R	1 R											3									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	2 1		2 1	1 3 R	2 1 R			1 R					1	2			2 1 4		1					2 1 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	1		2 1	1 R	2 1 R									1				1						
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	2 1			1 R								1		1		1	1	1	2 2	1		?	1	X	1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1		2 1	2 R	2 1 R															2 1 2					
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1		2 1	2 2 R	2 2 R			1 R	2 2	3 2	3 2	1	2 2	1							4 1 3 1	4 3	2		3
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	1		2 1	2 2 R	2 1 R			1 R	2 2		3 1		2 2	2			2 1 1				3 2 R	4 4 1			
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)				3 R							1	1			1								2	1	3
24 HEALTH SERVICES (SIC Major Gp 80)				1 R					?	1													1	3	2
25 GENERAL PUBLIC				1 1 R	3 2 1 R			1 R			2 1 R	2 1 R	1 R										2 R		2 2 1

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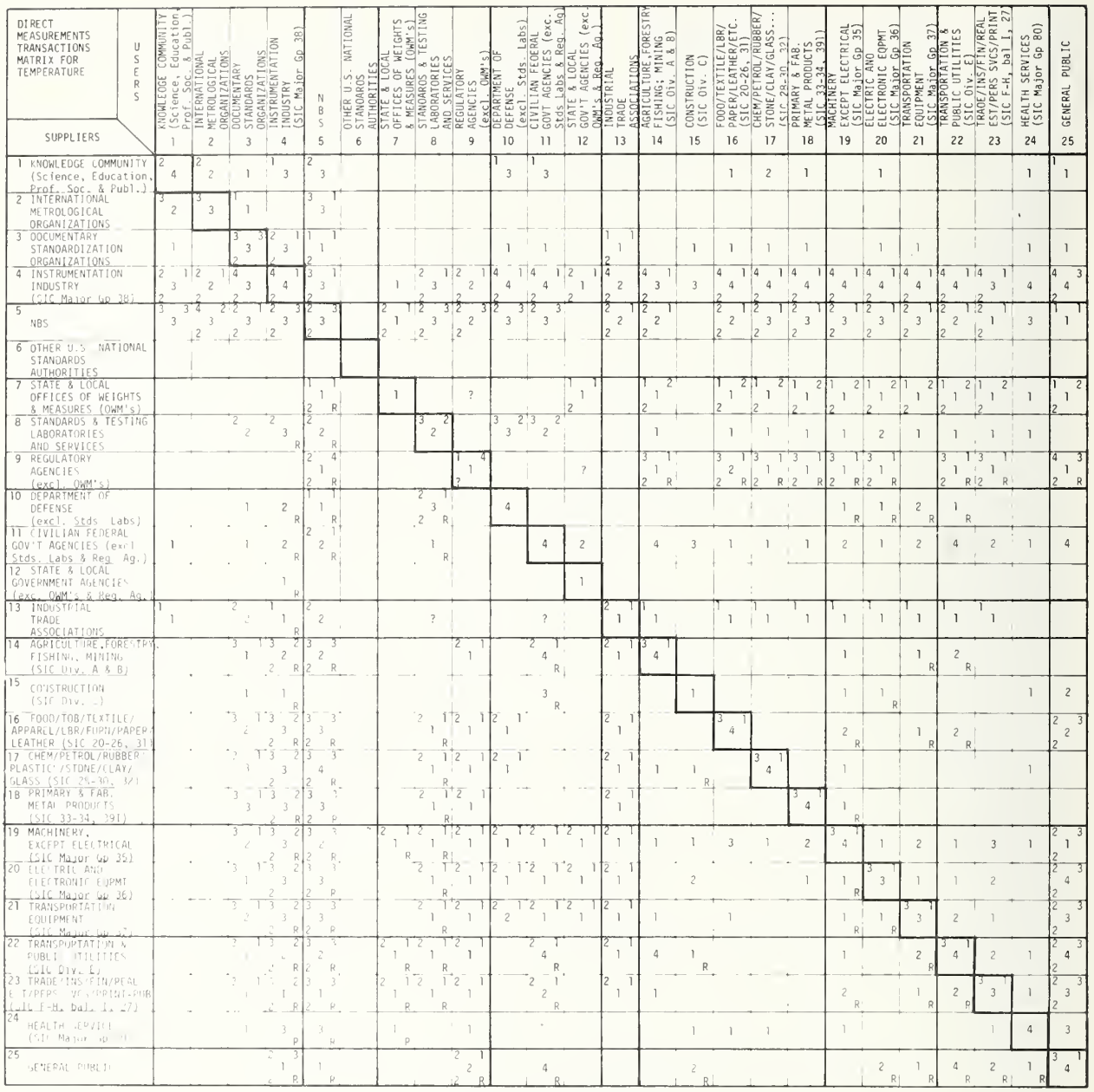

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR HUMIDITY & MOISTURE USERS / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds. Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 1 2		2 1 2	2 1 2	2 1 2		2 2	1		2 1 2	2 1 2		1	3		3	2		2 1 3	2	2			1	1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 OCCUMENTARY STANDARDIZATION ORGANIZATIONS	2 2 1		2 1 3	2 1 2	2 2 1		2 2 2	3		3	2		1	3 1 3 2	2	3 1 4 2	2 1 3	1	2 1 3	2 1 3 2	2 2			?	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 1		2 1 3	2 1 2	2 1 2		3 2 2	3		4	2 3	1	1	3 2 4 2	2	3 2 4 2	2 1 3	2	3 1 3	2 1 2 2	2 2	1	1	1	1
5 NBS	2 1 2		2 3 2	3 1 3	2 1 2		3 3 2 2	3 1 3		3 3	2 3 3	1		3 3 3 2		3 3 3 2	2 2 1		2 1 2	2 2 1	3 1 2			1	1 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)			2 2 1	2 2 2 R	2 3 2 R		2				1	1	1	2		?							?		
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1		2 2 2	1 R	2 2 1 R			2		2	2	1					1	1	1	1	1		1		
9 REGULATORY AGENCIES (excl. OWM's)																									
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 1 2		2 1 2	2 1 2 R	2 1 2 R			3 R		4	2					1 R			1 R	2 2 R	2 R				
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 1 3		2 1 3	2 1 3	2 1 2 R		2	1		2	4	2		4	3	3			2	3	2	4	1	2	1 4
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)							1 R	1 R				1													
13 INDUSTRIAL TRADE ASSOCIATIONS	1			1	1		1						2	3		3									
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	2		2	2 2 2 R	2 2 3 R		3 R				3	1	1	4		2	1		2 R			1 R			
15 CONSTRUCTION (SIC Div. C)			1	1 R											1			2 R	1 R						1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)	2		2	2 2 2 R	2 2 2 R					1	2		1	2		3			2 R						
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)			1	1 R	1 R					1	1			2			1		2 1 1						
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)			1	1 R														2					1		1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	2 2		1	2 1 2 R	1 R					1	2	1		2 3 2	1	3 3 2	1		2 1 3	2 2	1	1	3 3 2	3 2 2	1 1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)			1	1 R	1 R					2 1	1					1			1 R	2	1		1		1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 1 1		1	2 1 2 R	2 1 N R					2	1										2	1			
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)														2								1			2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)																		1 R	1 R	1 R			1	1	1
24 HEALTH SERVICES (SIC Major Gp 80)	2 1 1		1								1								1 1 1 R					3 2 2	3 2 1 2
25 GENERAL PUBLIC				1 R														1 R		1 R		1 R			1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

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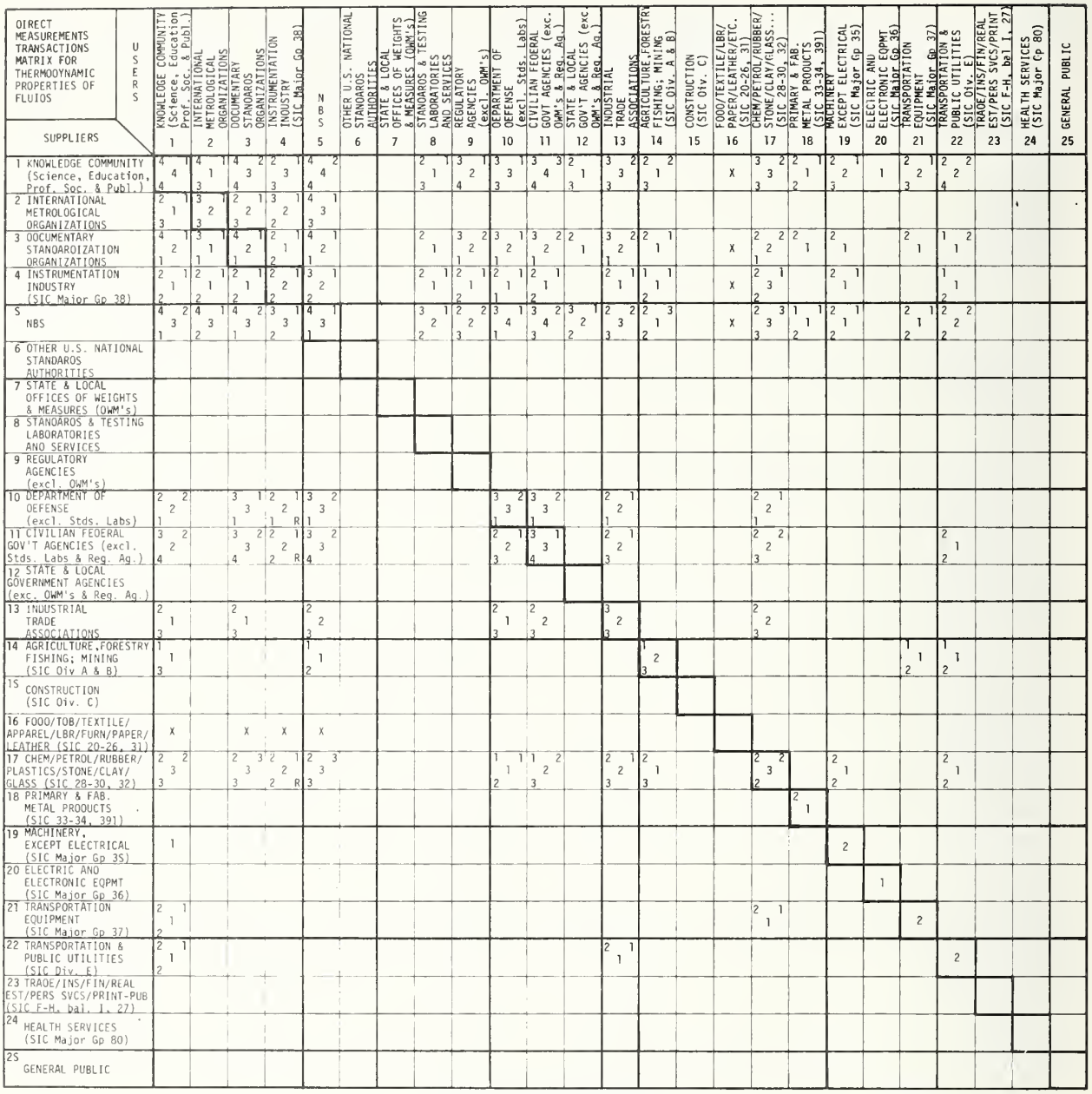

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR CRYOGENICS — SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 OOCUMENTARY STANOAROIZATION ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANOAROS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANOAROS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 OEPARTMENT OF OEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRAOE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Oiv. A & B)	15 CONSTRUCTION (SIC Oiv. C)	16 FOOO/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PROOUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Oiv. E)	23 TRAOE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4 1 4 2	4 1 2	4 1 2	2 1 3	4 1 4	3 1 1 2	3 1 2	2 1 2	3 1 2	2 1 3 2	3 1 4 2	2 1 3 2	2 3			1	2 3				2 3	2 3		1	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	4 1 1	4 1 3	4 1 2	2 1 2	4 1 2 2	3 1 1 2							3 3 1 3											
3 OOCUMENTARY STANOAROIZATION ORGANIZATIONS	4 1 1	4 1 2	4 1 3	3 1 3 2	4 1 3 2	3 1 1 2	3 1 3 2	2 1 2	3 1 4 2	3 1 2 2	2 1 2	2 1 2	2 1 3 2			1	2 3 2		1		2 3 2	2 3 2	1		2 1 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 2	2 1 3	3 1 3 2	2 3	3 1 3 2	3 1 1 2	3 1 2 2	3 2 3	3 1 2 2	2 3	2 3	2 1 2	2 3	1	1	1	1 4	2	1	1	1 2	1 3	1		
5 NBS	4 1 4 2	4 1 2	4 1 3	3 1 3 2	4 1 4 2	3 2 1 2	3 1 2 2	2 1 2	2 1 2	3 1 4 2	2 1 4 2	2 1 2	2 1 4 2				2 1 3 2				2 1 3 2	2 1 3 2	1		1 2 1 2
6 OTHER U.S. NATIONAL STANOAROS AUTHORITIES	3 1 1 2	3 1 1 2	3 1 1 2	3 1 1 2	3 1 2	3 2 2			2 2		2 1 2	2 1 2	2 1 2								2 1 2	2 1 2			
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	3 1 2		3 1 2	3 1 2 R	3 1 2 R		4 1 2	2 1 1	3 1 1 2			1 1 2	2 1 3 2				2 1 1 2				2 1 1 2	2 1 1 2			
8 STANOAROS & TESTING LABORATORIES AND SERVICES	2 1 1		2 1 2	2 3 R	2 2 R		2 1 1	2 1 2	2 1	2 1 1	2 2 2	2 2 2	2 2				2 1				2 2	2 1 2	1		
9 REGULATORY AGENCIES (excl. OWM's)	3 1 2 2		3 1 4 2	3 1 2 2 R	2 1 1 2 R	2 2	3 1 1 2 R	2 1 1	2 1 2 2	1 1 1 2 R	1 1 2 2	1 1 2 2	2 1 3 2				2 1 2 2 R				2 1 2 2 R	2 1 2 2 R		2 2 1 2 R	
10 OEPARTMENT OF OEFENSE (excl. Stds, Labs)	2 1 2 2		3 1 2 R	2 2	3 4 2 R	3 1 2		2 1 R	1 1 2	2 1 3 2	2 1 2 2	1 1 2	2 1 2				1 1 R				1 1 R	1 1 R			
11 CIVILIAN FEOERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3 1 3 2		2 2 2 R	2 2	2 1 4 2 R	2 1 2 2		2 1 2	1 1 2 2	2 1 2 2	2 1 3 2	2 1 1 2	2 1 3 2				1 1 1				1 1 1	1 1 1			
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	2 1 2		2 2 2 R	2 1 2	2 1 2 2 R	1 1 2	1 1 2 2	2 1 2 R	1 1 2		2 1 2		2 1 1				1 1 1 2				1 1 1 2	1 1 1 2			
13 INOUSTRIAL TRAOE ASSOCIATIONS	2 3		2 1 3 2	2 3	2 1 4 2 R	2 1 2 2	2 1 3 2	2 1 2	2 1 3 2	2 1 2	2 1 3 2	2 1 2	2 1 2				1 2				1 2	1 2			
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Oiv. A & B)			1											1			1 R				1 R	1			
15 CONSTRUCTION (SIC Oiv. C)															1										
16 FOOO/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)			1													2						1			
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	2 3		2 1 3 3 2		2 1 3 2 R		2 1 1 2	2 1 1 2	2 1 2 2	1 1 2	1 1 1 2	1 1 1 2	1 2	1	1	1	1 3		1 R		1 1	1 1			
18 PRIMARY & FAB. METAL PROOUCTS (SIC 33-34, 391)																	1	1	1						
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)			1													1 R	1		2		1	1	1		
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)																				1					
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 3		2 1 3 3 2 R		2 1 3 2 R	2 1 2 1	2 1 2	2 1 2	2 1 2	1 1 1 2	1 1 1 2	1 1 1 2	1 2		1		1		1 R		1 3	1 1			
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Oiv. E)	2 2		2 1 3 3 2 R		2 1 3 2 R	2 1 2 1 2	2 1 1 2	2 1 1 2	2 1 2	1 1 1 2	1 1 1 2	1 1 1 2	1 2	1			1		1 R		1	1 2			
23 TRAOE/INS/FIN/REAL EST/PERS SVCS/PPINT-PUB (SIC F-H, bal. I, 27)			1				1															1	1		
24 HEALTH SERVICES (SIC Major Gp 80)																								1	
25 GENERAL PUBLIC					1 2 1 2 R				2 2 1 2 R			3 2 1 2 R	2 2 1 2 R									1 1 R			

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR ELECTRICITY

SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING, MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS.. (SIC 28-30, 32)	18 PRIMARY & FAB METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	1 1 4 2	1 1 2 2	1 1 1 2	3 1 3 2	4 1 4 2			3 1 2 2	1	3	2		1				2 1 1 2	1 2 1 2	2 1 2 2	2 1 2 3 2 2	2 1 3 2	2 1 3 2		1	1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1 1 1 2	3 2 3 2	1 1 2 2	3 1 2 2	4 2 3 2																			1	
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS	2 1 1 2	2 1 1 2	3 2 3 2	2 1 3 2	2 1 1 2			2 1 2 2	2 1 2 2	2 1 2 2	2 1 2 2		2 1 2 2		1		2 1 1 2	2 1 2 2	2 1 2 2	2 1 4 2	2 1 3 2	2 1 3 2		2 2 2 2	1
4 INSTRUMENTATION INOUSTRY (SIC Major Gp 38)	2 1 3 2	3 1 1 2	2 1 4 2	4 2 4 3	3 2 4 3		3 1 1 2	3 1 4 2	3 1 3 2	3 1 4 2	3 1 3 2	3 1 1 2	2 1 2 2	1	2	1	3 1 3 3	3 1 3 3	3 1 3 3	3 1 4 3	3 1 4 2	3 1 4 3	2	3 2 3 3	2
5 NBS	3 2 3 3	3 1 3 2	2 1 3 3	4 1 4 3	4 1 4 3		1	3 2 4 2	3 1 3 3	2 2 2 2	3 1 3 2	3 1 2 2	1 1 2 2				3 1 1 2	3 1 2 2	1	3 1 3 2	3 1 3 2	3 1 4 1		2 1 2 2	
6 OTHER U.S. NATIONAL STANDAROS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)				2 1 2 R			1																		
8 STANDAROS & TESTING LABORATORIES AND SERVICES	3 1 2 2		2 1 3 2	3 1 4 2	2 2 3 R			3 1 4 2	3 1 2 3	3 2 4 2	3 1 3 2	3 1 1 2	2 1 2 2				3 1 3 1 2 2		3 1 3 2	3 1 4 3	3 1 3 2	3 1 4 2	1	3 1 2 3	
9 REGULATORY AGENCIES (excl. OWM's)	2 1 1 3		2 1 2 3	3 1 3 R	2 2 2 R			3 1 3 R	1 1 3	3 1 1 2	3 1 2 3	3 1 1 R	2 1 2 2	1 R	1 R	1 R	3 1 1 R	3 1 3 R	3 1 1 3	3 1 3 R	3 1 3 R	3 1 3 R	1	3 2 3 R	3 R
10 DEPARTMENT OF OEFENSE (excl. Stds. Labs)	2 1 2 2		2 1 3 2	3 1 3 R	2 2 2 R			3 1 3 2	1 R	3 ? 4 2			2 1 2 2				3 1 1 2	3 1 3 R	3 1 1 2	3 1 3 R	3 1 3 R	3 1 3 R		3 1 2 R	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 1 1 2		1 1 2 2	2 1 2 R	2 2 2 R			3 1 2 2	2 1 1 R	1	1 1 4 2	1 1 2 2	1				3 1 1 2	3 1 3 2	3 1 3 3	3 1 3 2	3 1 3 2	3 1 3 2		3 1 2 2	1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OSM's & Reg. Ag.)			2 1 2 R	2 1 2 R	1 2 1 R			3 1 2 R	1			2 ? 2 2													
13 INDUSTRIAL TRAOE ASSOCIATIONS	1		3 1 4 2	3 1 4 2	2 1 3 R			3 1 2 R					2 2 2 2						1	2	2	2			
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)														2					1 R						
15 CONSTRUCTION (SIC Div. C)			1	1 R											1										
16 FOOO/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																1									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)			2 1 1 2	3 1 1 2	2 1 1 R			2 1 2 R		3 1 1 2							2 1 3 3		1 R						
18 PRIMARY & FAB. METAL PROOUCTS (SIC 33-34, 391)			2 1 1 2	3 1 1 2	2 2 2 R			2 2 2 R		3 1 2 2	3 1 1 2							2 2 2							
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)			2 1 2 R	3 1 3 R	1 R			2 1 2 R		3 1 2 2	3 1 2 2		1	1		1			4	1 R		2			
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	3 1 3 2		2 1 3 2	3 1 4 2	2 1 3 R			3 1 4 2		3 1 2 2	3 1 3 2		2	1	1		3 1 2 2	3 1 2 2	4	4 4 3 2	3 1 2 2	2	1	1	1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	3 1 4 2		2 1 3 2	3 1 3 2	2 1 3 R			3 1 3 R		2 1 2 2	3 1 3 2		2	1			2 1 1 2	2 1 3 2	2 1 3 2	1 3 3 3	2 2 3 3	2 1 2 2			3
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 1 2 2		3 1 3 2	2 1 3 2	2 1 4 3			2 1 3 R	3 1 2	2	2	2	2	1	1	1	1	2	2	3	1	3 1 4 3	2	1	3 1 4 3
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)				1 R																			4	1	2
24 HEALTH SERVICES (SIC Major Gp 80)	1		2 2 3 2	2 1 2 R	2 1 1 R			3 3 1 R		3 1 2 3	1 R									1 R			1 R	3 2 3 2	1
25 GENERAL PUBLIC				1 R					2 R											1 R	1 R	1 R	1 R	1 R	2 1 3 2

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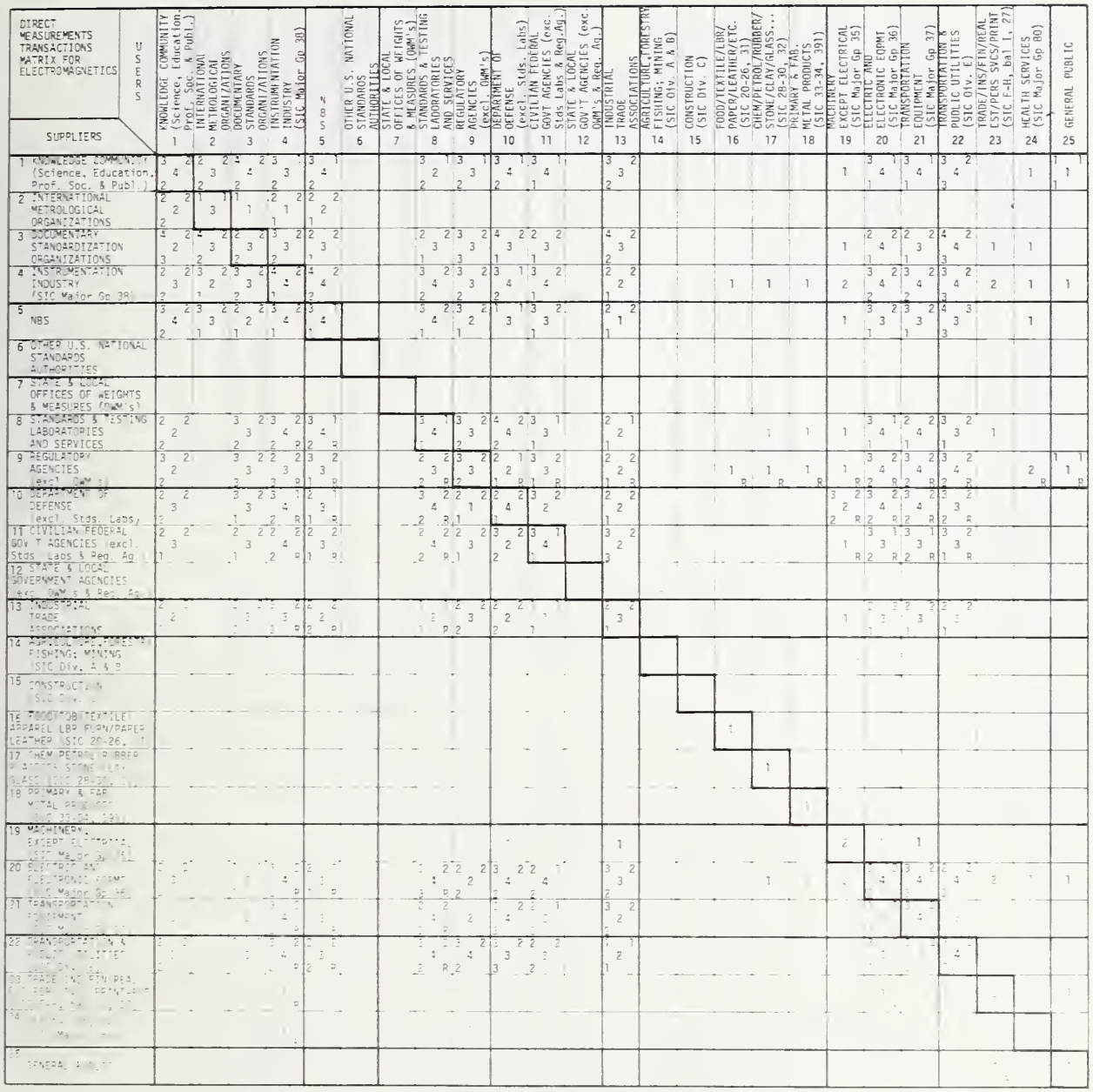

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1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3		2	2	2 2 2				1		2													2 ? 2 4	2 ? 1 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS		1			1																				
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	2		3	2	2				2				?											3	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2		2	2	2 3 1				1		2													3	
5 NBS	3 2 2 3	2 2 2 4	2 2 2 2	2 3 2 3	2 1 1				3 1 3 2		1		2 1 2 1											3 2 1 2	
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8 STANDARDS & TESTING LABORATORIES AND SERVICES																									
9 REGULATORY AGENCIES (excl. OWM's)	2		2	2 R	3 1 2 2				2		?													4 ? 3 2 R	
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)																									
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2				2 3 1						3													3	1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																									
13 INDUSTRIAL TRADE ASSOCIATIONS					1								1												
14 AGRICULTURE,FORESTRY, FISHING, MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)																									
16 FDDD/TDB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																									
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23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)																									
24 HEALTH SERVICES (SIC Major Gp 80)	3		2	3 R	3 R				2		3													3	2
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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR ACOUSTICS — SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 1 3 2		2 1 3	1 1 2	2 1 3			2	2	4	2	1	1	2	3	2	2	2	3	3	3	2		3	1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDS ORGANIZATIONS	1		2 2 3 2	2 1 3 1	2 2 4 2			2 1 3 2	2 3 2	X	2	1	3 2 3 2	1	2 1 4	1	1	1	2	3	2 4 1	1		3	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 3 1		2 1 2 2	2 3 2	2 1 3 2			3 2 3 2	2	3 1 4 3	2 1 3 2		2 1 3 2	3	3	3	3	3	3	3	3	2	1	3	
5 NBS	2 2 3 N		2 1 3 1	2 1 3 4	2 1 3 2			2 1 2 1	3 3 4 1	2 1 2	2 3	2	3 2 3 1		2		1			2 1 3 2			2 3 1 2	2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1		3	2 1 3 2 R	2 1 2 R			1 2	2 1 4 2	X	2		3 4 2	2	3	3	3	3	2	2	3	2	1	1	
9 REGULATORY AGENCIES (excl. OWM's)	1		1	2 R	3 3 3 1 R			3 1 3 2 R	3 3 4 1	X	2 R	1 R	3 1 4 3 R	4 2 4 R	4 1 3 2 R	4 2 4 R	2 R	2 R	4 1 2 2 R	2 2 2 R	4 1 3 2 R	4 1 3 2 R	1 R	4 3 3 4 R	3 2 2 4 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	3		1	2 2 4 2 R	1 R			X	X	4	X		X	X	X	X	X	X	X	4 R	X		X	X	X
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2		2	2 1 3 1 R	2 3 R			2 R	1	X	3 3 2	1	3 1 2	1	1					1 R	3	3		1	3 1 2 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	1				1 R			2 R	1	X		2		1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R		2
13 INDUSTRIAL TRADE ASSOCIATIONS	1		2 2 3 2	2 1 3 2 R	2 1 4 1 R			3 1 3 2 R	2 1 4 2	X	2 R		2 1 3 2 R	1	1	1	1	1	1	1	1	1	1		2
14 AGRICULTURE,FORESTRY, FISHING; MINING (SIC Div. A & B)	2			2 R	1 R			1 R	2	X				4						2 R					
15 CONSTRUCTION (SIC Div. C)	2 3		3	1 R	3 R			3 R	3	2	2	2	2		2 3 2						1 R	1 R	1	1	3
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)	1			1				2 R	3 1 2	X	1	2	2		2 R	2			2 R						1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)				2 R				2 R	3	X		2	2		1 R		2								
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	1			2				2 R	3	X		2	2		1 R			2	2 R						1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1		4 1 3	2 R	3 R			2 R	2 1 4 2	X	2	2	2	2	2	2	2	2	2 1 3 2	2	2	2			1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1		2	2 R	2 R			2 R	1	4	2	1	2	2					1 R	3					1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2		3	1 R	2 1 2 R				3 1 3 2	2	1	3 1 2	4 4	1	1	1	1	1	1	2 1 3 1	1				1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2				3			2 R	3 1 3 2		1	3	3							2 R	2				1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)				1 R																		2			
24 HEALTH SERVICES (SIC Major Gp 80)	2		1	3 R	2 R			2 R	2	X	2	2		1	1	1	1	1	1	1	1		3 2 3 3		1
25 GENERAL PUBLIC	1 P				1 R			1 R	1 3 2 R	X	2 R		2 1 1 2 R							1 R					1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR RADIOMETRY & PHOTOMETRY

USERS / SUPPLIERS

SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Req Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Req. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRING (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3 2 3 2 2	3 2 3 2 2	3 2 3 2 2	3 3 3 2 2	3 2 3 2 2			3 3 3 2 2	2 3 2 2 2	2 3 2 2 2	2 3 1 2 2		2 3 1 2 2		1 1 2	1 1 1 2				3 3 2 2				1 1	1 3 1 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 1 2 2 2	2 1 3 2 2	4 1 3 2 2	2 2 2	3 1 3 2 2																			
3 OOCUMENTARY STANDARDIZATION ORGANIZATIONS	4 3 3 2 2	4 2 3 2 2	3 2 4 2 2	2 3 2 2 2	4 2 2 2 2			3 2 1 2 2	2 1 1 2 2	1 2 2 2 2	2 3 1 2 2		3 2 1 2 2		1 1 2					2 3 3 2 2	1 2			1 2	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 2 3 2 2	4 1 2 2 2	2 1 3 2 2	4 1 4 2 2	4 1 2 2 2			4 1 2 2 2	4 1 3 2 2	4 1 3 2 2	4 1 3 2 2		3 1 3 2		1 1 2	1 1 2				4 1 3 2 2	1 2		3 2	1 4 3 2	
5 NBS	3 1 4 2	3 1 3 2	2 2 3 2 2	3 1 4 2	4 1 3 2			4 1 4 2 2	4 2 2 2 2	2 1 3 1 N 2	3 1 3 2 2		2 1 4 2		1 2					3 1 4 2				3 1 2	
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																								
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																								
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 1 2 2	2 1 2 2 2	2 1 2 2 2	2 2 3 2 R 2	3 1 2 2			3 1 3 2	2 1 3 2	4 2 3 N 2	2 2 2 2		2 1 2 2		2 2					2 2 2 2	1		1		
9 REGULATORY AGENCIES (excl. OWM's)	3 1 3 2	2 1 3 2	2 1 1 3 2	3 1 3 2 R 2	3 1 2 2			2 1 2 R 2	3 1 3 2		2 1 2 2		2 1 2 2		2 2		1 R	1 R		3 1 2 2 R	1 R			2 R	4 3 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 1 2	2 1 2	2 1 2 2 R	2 1 2 R	2 1 1 2			4 1 1 3 R	1 1 1	4 1 4	1 1 1		2 1 2		2 2					2 1 1 R					
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Req. Ag.)	2 1 2 2	2 1 1 2	2 1 2 2 R	3 1 2 2	3 1 2 2			2 1 2 1 2	2 1 3 2	1 1 1	3 1 3 2		2 1 2 2		2 2					2 1 1 2			1	2 1 1 2	
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Req. Ag.)																								
13 INDUSTRIAL TRADE ASSOCIATIONS	2 1 2 2	2 1 3 2	2 1 4 2	2 1 4 2	3 1 4 2			2 1 2 2	2 1 1 2	1 1 1	2 1 2 2		2 1 4 2		1 2					2 4 2	1			1 1	
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)																								
15 CONSTRUCTION (SIC Div. C)	1		1		1 R								1		1					1 R				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)	1															1				1 R				
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1																1			1 R				
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)																								
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																								
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	2 2 3 2		2 1 4 3 2	4 1 3 2 R	4 1 3 2			4 1 3 2	4 1 2 2	4 1 2	4 1 3 2		3 1 4 2		3	1	1			4 4 2	3			2	4 1 3 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)			1						1				1							2 R	1		1 R	1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)																								
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)				1 R											1					1	1		3	2
24 HEALTH SERVICES (SIC Major Gp 80)	1		1	1 R					1 R											1				1
25 GENERAL PUBLIC				2 1 2 R	3 1 2 R				2 1 2 R		2 1 2 R									2 1 2 R			2 R	3 3 2

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR SPECTRO-PHOTOMETRY — SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 1 3 2		2 1 3 2	2 1 2 2	2 1 3			2 1 2 2	2 2 1 2	2 ? 2 2	2 ? 2 3	1 ? 1 2	1 1 1 2			2 2 3 2	2 2 3 2	1 2		2 2 2 2	2 2 2 2	2 2 2 2	2 2 1 2	2 2 1 2	2 2 3 2	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1 2 2	X	1 1 2 2	1 2 2 2	2 2 2 2			1 2 1 2	1 2 1 2				1 3 1 2												
3 DOCUMENTARY STANDARDS ORGANIZATIONS	2 1 1 2	X	2 2 2 2	2 3 2 2	2 2 2			1 3 2 2	2 3 2 2	2 ? 2 2	2 3 2 2	2 2 2 2	2 2 2 2			2 3 2 2	2 3 2 2			2 3 2 2	2 3 2 2	2 3 1 2	2 3 2 2	2 2 2 2	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 3 2	X	2 3 2 2	2 3 3 2	2 1 2			2 1 2 2	2 3 1 2	2 ? 2 3	2 3 2 2	2 2 1 2	2 1 2 2	1		2 3 3 2	2 3 4 2	1		2 3 2 2	2 3 2 2	2 2 1 2	2 2 2 2	3 2 3 2	2 2 3 2	
5 NBS	2	X	1 3 2 2	1 3 2 2	1 1 2			2 2 2 2	2 1 2 2	1 1 1 2	2 3 2 2	1 1 1 4	2 2 2			2 3 2 2	2 3 2 2			2 3 2 2	2 3 2 2	2 3 1 2	2 3 2 2	2 1 2 2	
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 1 1 2		2 2 1 2	2 1 2 2	2 1 2 2			2 2 2 2	2 1 2 2	2 1 2 2	2 1 2 2	2 1 2 2	2 1 1 2			2 1 2 2	2 1 3 2			2 1 2 2	2 1 2 2	2 1 1 2	2 2 4 2	1
9 REGULATORY AGENCIES (excl. OWM's)	1 1 1 2		2 2 1 2	2 2 1 2 R	2 1 2 2 R			2 2 2 2 R	2 2 2 2		2 3 1 2 R		2 3 2 2 R			3 2 2 2 R	1 1 1 R			1 1 1 2 R	2 3 1 4 R	2 3 1 4 R	2 2 2 2 R	
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 2 3 2		2 1 2 2	2 2 2 2 R	2 1 2 2					2 ? 4 3	1 1 1									2 1 1 2 R				
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 1 3 2		2 1 2 2	2 2 2 2 R	2 1 2 2			2 3 2 4 R			2 3 3 4	2 2 2 2				2 2 2 2	2 2 2 2			2 2 1 2	2 3 1 2	2 3 1 2	2 2 2	
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	1		2 2 1 2	1 1 1 R	2 2 1 2				2 1 1 2			2 2 2 2	2 1 1 2											
13 INDUSTRIAL TRADE ASSOCIATIONS	1		2 2 2 2	2 2 2 R	2 1 2 2			2 1 1 2	2 2 1 2		2 2 1 2	2 2 1 2	2 3 1 2			2 2 2 2	2 2 2 2	1		2 1 1 2	2 2 1 2	2 2 1 2	2 ?	
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)														1											
15 CONSTRUCTION (SIC Div. C)																									
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)	1		2 3 2 2 2	2 2 2 R	2 2 2 R			2 1 2 2 R	2 2 2 2	2 2 1 2			2 2 2 2			2 3 3 2						1		3 2 3 2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1		2 3 2 2 2	2 2 3 R	2 1 2 R			2 1 2 2 R		2 2 2 2							2 3 4 2					1		2 1 2 2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)			1															1						
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																									
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)			2 3 2 2 2	2 2 2 R	2 1 1 2 R			2 1 1 2 R		2 2 2 2									2 3 2 2					2 1 1 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)			2 3 2 2 2	2 2 2 R	2 1 1 2 R			2 1 1 2 R		2 2 1 2										2 3 2 2				2 1 1 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)			2 1 2	1 1 R																	2 2 1 4			
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)	1		2 3 2 1 2	2 1 R	2 1 1 2 R			2 1 1 2 R		2 2 1 2												2 3 2 2		2 1 1 2
24 HEALTH SERVICES (SIC Major Gp 80)	1		2 2 2 2 2	2 3 R	2 1 1 2 R				1														2 2 4 2	1
25 GENERAL PUBLIC																						1 R	2 R		

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USERS

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A
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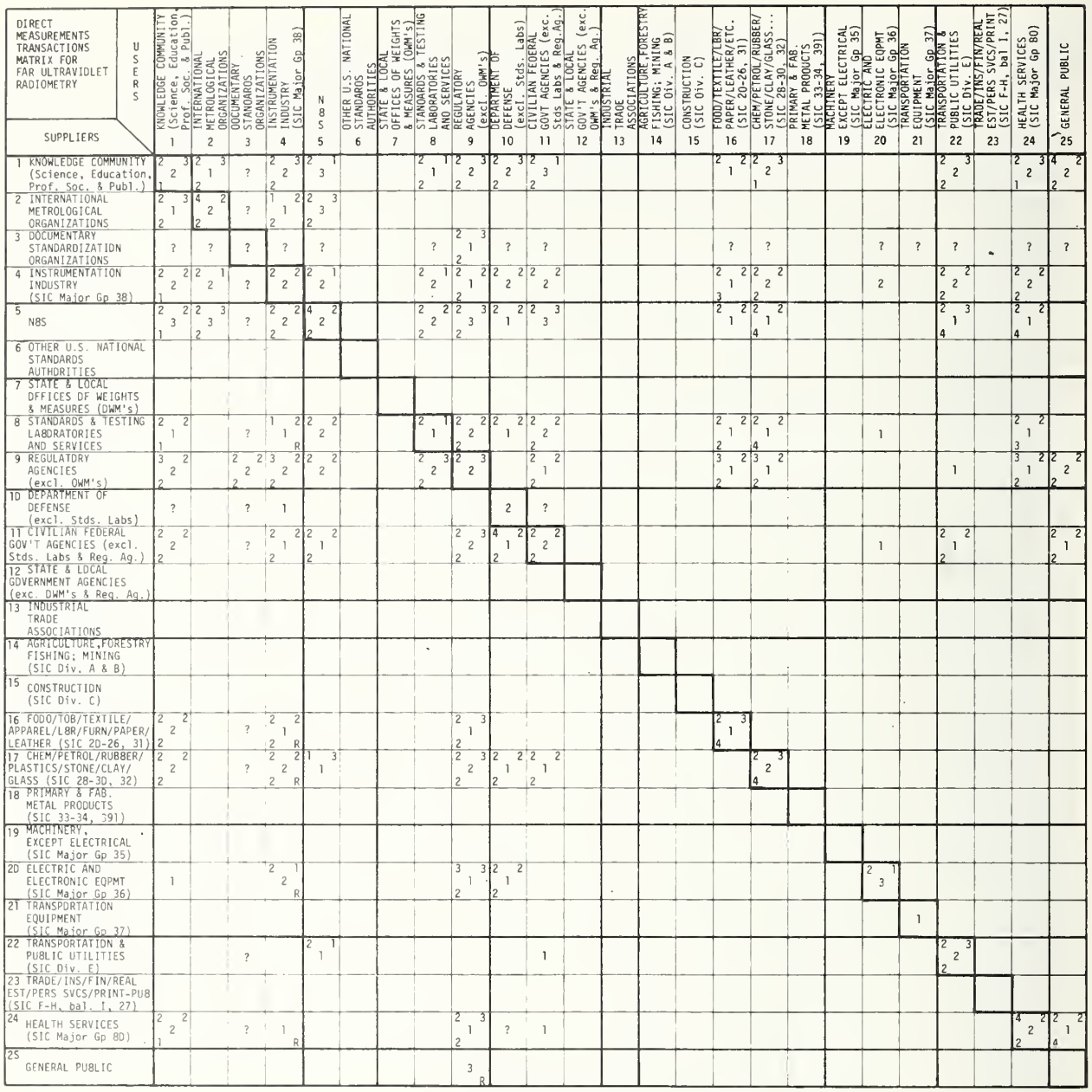

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OPTICS SUPPLIERS \ USERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 N8S	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE/FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal. I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3		2	3	4 3 1	1		2	2	3	2				1		1	2	1	1	2	2	1	2	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	2		3	4 3	3 3 1	2		3	3	2	2				2		2	3	2	1	3	2	2	1	
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 3		4 3	4	4 1 3 1	1		3	2	4	4	2			3		2	3	2	1	3	4	3	4 2 4 2	4 1 4 2
5 N8S	2 1 2		2 2 1	3 1 3	3 2 1	1 1 N		4 3	3 1	4 3	4 1 2	1 1			2 1 2		1	4 4	4 2		4 4	2 3	2 1	1 1	
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	1		1	1	2 1	2					2	2			2							2	1		
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1		2	1 R	2 2 1 R			2		2	1	1			2		1	4 3	4 2		4 3	2	1	3	
9 REGULATORY AGENCIES (excl. OWM's)	1		1	2 R				1 R	2		3 R	1 R			2 R		3 R	1 1 4 R	1 1 2 R		1 1 3 R	3 R		2 R	1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2		2	4 R	1 3 R			1 R		4	1							3 R	1 R		4 R			2 R	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1		1	3 R	2 R	2 R		1 R	1		3	1						4 2 R			4 2 R	2 R		2 R	1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)				1 R		2 R		1 R			1 R	1													
13 INDUSTRIAL TRADE ASSOCIATIONS																									
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)			1	1 R	3 2 R	2 R		1 R	1		1				3			1 R			2 R	2			
16 FDDD/TDB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																									
17 CHEM/PETRDL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	1		2	1 R	1 R				2	1	2						2				1 R	2			
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	2		2	1 R	2 1 1 R			4 3 R	3	3	3				4 1 2 2		2 R	4 4			2 R	1	4 1 4 2		4 2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1			1 R	2 1 1 R			4 1 R	1	1	1								4 2	1 R	1	4 1 2			
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1		2	3	1 R			2 R	1	3	2	1			3		2	3	2	3	2	3	2	4	
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2		1	1 R	2 1 1 R			4 3 R	2	4	2							1 R	1 R	1 P	4 4	4 1 3			
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3		3	2 R	3 3 R	2 P		2 R	2		3				2 R		1 R	3 R		2 R	2	4			
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)			1	2 R	3 2 R			1 R		1	1									1 R			4		2
24 HEALTH SERVICES (SIC Major Gp 80)	1		2	4 R					2	3	1	1								2 R				3	4 4
25 GENERAL PUBLIC				1 R	1 P				1 R		1 R	1 R									1		1 P	2 R	1

KEY TO MATRIX ENTRIES

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1 = Purely convenience
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USERS

C D
A
B R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR LASERS — USERS / SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 8D)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4 4	3	4 3	3 4	4 4				4 3	4 4	4 4		1		4 1		4 3	4 1	1	3 3	3	4 2	4 1	4 2	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1	1			1																				
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS	1		2	2	2				1	1	1	1	1		1	1	1	1		2	1	2	2	2	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	1	1	2	3	2			1	3	4	3	1	3		1	1	2	1	1	3	2	2	2	1	
5 NBS	4 3	4 2	4 3	4 2 4	4			2	4 4	4 4	4 4	1 3 1	1							4 2 4	4 2 3	3	3		
6 OTHER U.S. NATIONAL STANOARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES				1 R				2	1	2	1									1	1	1			
9 REGULATORY AGENCIES (excl. OWM's)	1		1 2 4	1 2 4	2			1	4 3	2 R	3 R	4 2	2		1 R	1 R	4 2 R	4 2 R	4 1 R	2 4 4 R	2 R	3 2 R	3 2 R	4 1 R	1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	4		1	3	3					4	2									4	2	2	2		
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.	3 3 2		3 2	3 3 2	3 3				2	3 2 2	3 3 2	1	1			1	1	3 1	1	3 3 2	1	3 1		3 2	
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)				1 R	1 3 1 2 R				1			1 3 1 2	1		3 1 R	3 3 1 R	3 3 1 R	3 3 1 R		1 R		1 R	4 3 1 R	1 R
13 INDUSTRIAL TRADE ASSOCIATIONS	1		1	1	1 R				4 3	1	1	1 3 1	1		1	1	1	1		1		1	1	1	
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)	1		1	1 R	1 R				1	1			2		1					1 R					
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)			2	1 R	1 R				1		1		2			1				1 R					
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-3D, 32)	2		2	2 R	1 R				2	1	1		2				2			1 R					
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	1		2	1 R	1 R				1	1	1		2					1		1 R					
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)			1	1 R															1	1 R					
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	3		3	3 R	1			1	2	3	3		3		1	1	1	1	1	3	2	2	3		
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	3		1	2 R	1								2							2 R	2				
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2		1	2 R	2				1	1	1		2							2 R		2			
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1		2	2 R	1 R				2	1	1	1 3 1	3							2 R			2		
24 HEALTH SERVICES (SIC Major Gp 8D)	2		2	2 R	1 R				1	1	2	1 3 1	2							2 R			1	1	1
25 GENERAL PUBLIC					1 R				1 R		1 R	1 2 1 2 R								1 R			1 R	1 R	

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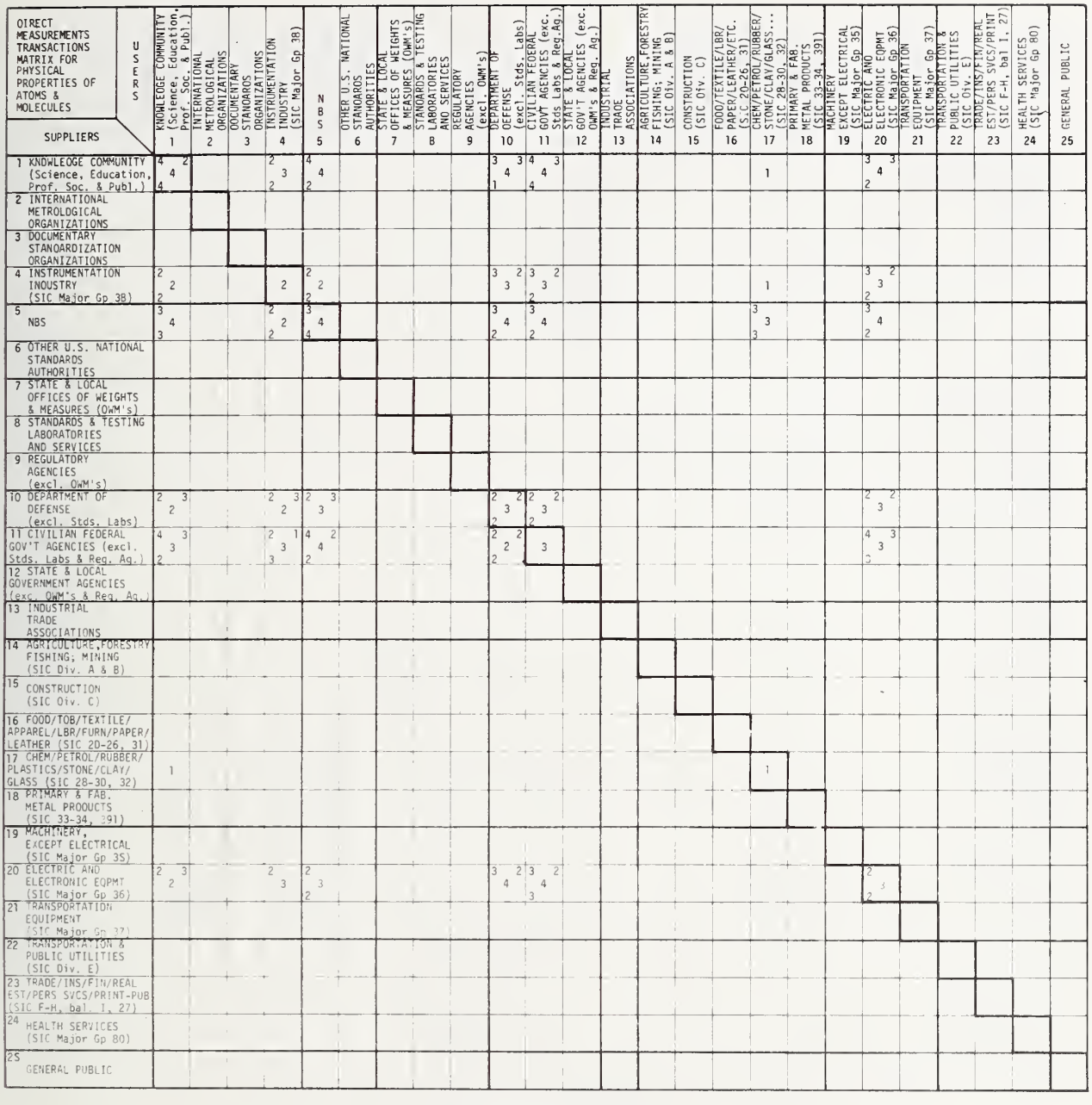

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR SURFACE PROPERTIES

USERS

SUPPLIERS

SUPPLIERS	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4 2 4 3		2 2 2	3 2 2 3	3 2 3 3			2 2 1 2		3 2 3 3	3 2 3 3						3 2 3 3	3 2 3 3		3 2 3 3	3 2 3 3			1	
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	2 2 1 1		1	2 2 1 1	3 2 1 1			2 2 1 1		2 2 1 1	2 2 1 1						2 2 1 1	2 2 1 1		2 2 1 1	2 2 1 1				
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 1 3 3		2 1 2 1	1 3 1 3	3 1 2 3			3 1 1 2		3 1 3 3	3 1 3 3						3 1 3 3	3 1 3 3		3 1 4 3	3 1 3 3			1	
5 NBS	4 1 3 2		3 1 2 2	3 2 2 2	3 2 3 2			2 2 1 2		3 2 3 2	3 2 2 2						3 2 3 2	3 2 3 2		3 2 3 2	3 2 3 2				
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 2 1 2		2 2 1 2	2 2 1 2	2 2 1 2			2 2 1 2		2 2 1 2	2 2 1 2						2 2 2 2	2 2 2 2		2 2 2 2	2 2 2 2				
9 REGULATORY AGENCIES (excl. OWM's)																									
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	3 2 3		2 2 1 2	3 2 2	3 2 3			2 2 1 2 R		4 2 3 3	3 2 3 2						2 2 2 2	3 2 2 2		3 2 3 2	3 2 2 2				
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3 2 3 3		2 2 1 2	3 2 2 2	3 2 3			2 2 1 2		2 2 2 3	4 2 3 3						2 2 2 2	2 2 2 2		2 2 2 2	2 2 2 2				
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																									
13 INDUSTRIAL TRADE ASSOCIATIONS																									
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)																									
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	2 2 2		2 2 1 2	3 2 2 2	3 2 3			2 2 1 2		2 2 2 2	2 2 2 2						4 2 3 2	2 2 2 2		2 2 2 2	2 2 2 2				
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	2 2 2		2 2 1 2	3 2 2 2	3 2 3			2 2 1 2		2 2 2 2	2 2 2 2						2 2 2 2	4 2 3 3		2 2 2 2	2 2 2 2				
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																									
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	2 2 3		2 2 1 2	3 2 3 2	3 2 3			2 2 1 2		2 2 2 2	2 2 2 2						2 2 2 2	4 2 3 3		4 2 3 2	2 2 2 2				
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 2 2		2 2 1 2	3 2 2 2	3 2 3			2 2 1 2		2 2 2 2	2 2 2 2						2 2 2 2	2 2 2 2		2 2 4 3	2 2 2 2				
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)																									
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. 1, 27)																									
24 HEALTH SERVICES (SIC Major Gp 80)																								1	
25 GENERAL PUBLIC																									

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR IONIZING RADIATION — USERS → / SUPPLIERS ↓	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3 4	3	3	3	2 3			3	3	3	4	1		2		2	2	4		2	2	4	3	4	2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	2	4	3	2	4																				
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS	2	4	4	3	4			3	4	2	4	3		2		2	4	4		3	2	4	3	4	2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3	2	2	3	4			3	3	4	4	1		3		2	4	4		3	3	4	3	4	1
5 NBS	2 1 3	3 2 4 2	3 3 4 3	3 1 4 3	4			3 3 3 2	3 4 3	3 2 D	4 3 2	4 3 4	3 3	2 2 3 2		2 2 1	2 4 2	2 4 4	3 4 2		2 2 4 3		4 4 4	3 4 3	4 4 4	1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)																									
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2	1	3 2 2 R	1			2	3 2	2	3			1		1	3	3 2		1	2	3 3 2	3 3 2	4 2 2	4 3 2	3
9 REGULATORY AGENCIES (excl. OWM's)	1	4	3 R	4 3 4 R			3 P	4	3 R	4 R	3 R		3 R	2 R	4 R	4 R			3 R	2 P	4 3 R	4 R	3 R	2 P
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	1	2	3 R	3 R			2 R	2	4	3				1	3 R	4 R			2 R	3 R	2 R	2 R	2 R	1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3	4	3	4			2 R	4	2	4	1		2 R	1 R	4 R	4 P			1 R	2 R	4 R	2 R	4 R	2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1							1 P	1 R	1										2 R		2 R	1 P
13 INDUSTRIAL TRADE ASSOCIATIONS																									
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	1	2	2 R	1 R				3	1	3			4			2	1				1		1 R	1
15 CONSTRUCTION (SIC Div. C)																									
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)		1	1 P	1 R				1	1	2					2									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)	2	3	3 R	3 R			2 R	4	3	4			3			4	3		1	1	2	3	1 R	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	3	4	4 P	3 R			2 R	4	4	4			1 R			1 R	4		2 P	2	4	3	1 P	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																									
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	2	2	2 R	2 R				2	2	2						1	2		3	1	2	1	2	1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1	2	2 P	2 P				2	3	1							2 P		1 P	3		1		
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3	4	3 R	3 R			2 R	4	1	4	1		1 R			1 R	3 R		2 R	1 P	4	3	1	2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-RUB (SIC F-H, bal. 1, 27)	2	3		3 2			2 R	4	3	3			3	2	4	4			2	2	4	3	3	2
24 HEALTH SERVICES (SIC Major Gp 80)	3	3	4 R	4 4 2 3 R			3 P	3	1	2	1		2	1	2	2			2	1 P	2 P	4	2 P	3
25 GENERAL PUBLIC		2 P	1 P	1 P				3 P	2 R	2 R	2 R					2 R	2 R		1 P	1 R	2 R	1 R	2 R	1

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Sector 1. Knowledge Community (Science, Education, Professional Societies and Publishers).

Scientific organizations, the general scientific community; academic institutions (elementary & secondary schools, colleges & universities, vocational training institutions), libraries, information centers, museums, botanical & zoological gardens; domestic & international professional, scientific and technical societies; technical publishing houses; and the like. Note that research and development activities closely aligned with specific economic sectors are usually accounted for in connection with those sectors, so that some care to avoid double counting is necessary. Further, the documentary standardization activities of professional organizations are covered in sector 3, and the technology of printing and publishing in sector 23.

This sector is both a major supplier and a major user of measurement information, goods and services. The development of new knowledge depends vitally upon the existence of suitable measurement capabilities. Without a constantly expanding measurement capability, experimental science would soon grind to a virtual halt, and the pace of theory would be dramatically slowed.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO KNOWLEDGE COMMUNITY — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	4	3	2 2	4 2 3 2	1 2	3	3	4 4	2 4	2 1 2	4 1 4 4	4 1 4 2	1 1 4 2	3 2 4 2	3	2 1 3 2	3 2 3 2	2 1 3 2	2 3 1	3	4 4	4 2 4 4	4 2 4 3	3 4	4 1 6 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1	1	2 1	2 1 1	1			3 1	3 2		2 1 3	4 1 1	1 1 2	2 2 2			3 2 2	1 2	2 3 2		1			2	2 1 1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		1 1	2 2	2 1 2 2	1	1	1	1	1	2 2 1	4 1 2 1	4 1 1	2 1 2	4 2 2 3	2	1	4 3 3 2	2 1 1	?	2	1		2 2 1 1	2	3 2 1 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	1 2	2 2 1	3 2 3	1 2	2	2 2	2 2	2 3 2	2 1 1	2 1 2	2 1 2	2 1 3 2	2 2 3 2	2	2 1 3 1	3 2 3 2	2 1 3 2	2 2 2 1	2 3	1	2 2 2	3 1 3 3	3	2 1 2 1
5 NBS	2 3	1 1 1	3 2 2 2	3 1 2 2	4 1 4	2 3 2	2 1 3 2	3 2 1	3 3 3	2 1 2	4 2 3 1	4 1 4	3 2 3 3	3 2 4 2	3 2 3	2 2 N	3 1 4 2	2 2	2 2 1 3	2 1 2	4 3	3 4 3	4 1 3 2	2 1 3	3 1 3 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2											3 1 1 2								1					1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)												3 1 2													
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1	1 1 1	2 2 1	1 1		2 2	1	2 1		1		2 1	3 1 2	2 2 2		1	2 1 2 2	2 1 2 1	2 2 1 1	1			2 2 1 2	2	2 1 1 1
9 REGULATORY AGENCIES (excl. OWM's)			1			1	1					3 2 2	2 1 3	3 2 2	2	1	3 1 3 2	1 1 2	3 2 2	1	1			1	3 1 2
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2	1	2 1 1	2 2	1	2 2 2	4 1 3	1 1		2 1 2	2 2 1	2 1 2	2 1 2	2 1 3 2		3	2 1 2 2	2 2 3 2	?	2	4	2 2 3	3 2 3	1	3 2 2
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2	1	2 2 1	2 2	2 1 N	2 2 2	3	2 2	1	2 1 3	3 2 4	3 1 2	2 1 2	2 2 1	2	2	2 1 2	2 1 2	2 2 2	1	3 3 2	4 3 2	3 2 3	3	3 1 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)							1					2 1 2				1		1							1
13 INDUSTRIAL TRADE ASSOCIATIONS				3 3				1	1 1	1	2 1 3	2 3	1	2 2 1		1	2 1 2	1			1				2 1 1
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)					1		1			2	1 3					2								1	1
15 CONSTRUCTION (SIC Div. C)							1									2 3	1				1				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				3 3 2 2		2 2				2	X					1	1	1	2 2 2						1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)				1	1	2 2	1	2 1			2 2 3 3	2 3					1	1	2 2 2	1	2	1	2 2 2	2	2 1 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1 1 1		2 1 3		2 2		1								1				2	1		2 2 2	3	2 1 1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		1 1 2	1	2 1 3	1	1 2	1	2 1		2 2	1			1		1				1					2 1 1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1	1	1	4 1 4 2		1 1		1					3 1 3 2	2 2 3 2		1	2 2 3 2		1	1	3	2 3 2	2 2 2 3	2	3 1 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		1 1 1	1 2 2 N	3 3 2		2 2	2 1 3	1		2 1 1	2 1 1 2	2 3	3 1 4 2	3		2				2	3		2 2 2	1	2 1 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 2		1			2 2	2 1 3	1			2 1 2	2 2	2 1 2 2	2 2 3 2		2				2	2			3	2 1 1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		2 1 1																1			1			2	1
24 HEALTH SERVICES (SIC Major Gp 80)		1		3 3 2	1		1			2 1 1			1	1	3	2	1	1	2 2 1	1	2			3	1
25 GENERAL PUBLIC		1 1 1 R														1 R									

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF KNOWLEDGE COMMUNITY USERS MEASUREMENT SECTOR	* KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	U S G S 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal J, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY	4	3		2	2 3	3		2	1	3	3										2	1	2			
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3	2	1 1	1 1 2	1 1 2			1 1 1		3	4				1					1 1 1	2	1 1	1	2 1 1		1 1 1
3 VIBRATION & SHOCK	2 2	2 2	2 2	2 2 1	2 2 2			2 1	2	2 1	2 2								1	2 1	2 3 1	2 2 2 1	2 1			
4 SURFACE FINISH	4 2 3 2	4 2 2	4 3 2	4 3 2	4 1 3 2			2 2 2		2 3 2	2 3 2		2 3 2			2 2 3 2	3 3 2	2 2	2 2 2	2 3 1 3	3 2 2			3 1 3	
5 MASS, VOLUME & DENSITY	1 2	3 2 2	2 1 2	3 2 2 N	4 1 2			1	2 1 2	2 3 N	1			1				2 1 2		2 2 1				2 1 1 2	
6 FORCE	3	1	2	2	2 3			1	1	2	2				1	1	1	3	3	1	3				
7 FLUID FLOW	1 3		2 4	2 2	4 3			2 2	2 3 2	2	2	2	2	1 2	2 1		1 2	1		1	2 1 2	2 1 3 2		1	2 1 1
8 PRESSURE	4 4	3 1 2	3 3 2	2 1 3	3 3		1 1 1	1 2	3 1	3 1 2	3 2 3	2 1	2 2			1	2 2 2	2 2	1	3 2 1	3 2 1	2 2			
9 TEMPERATURE	2 4	2 2	1	1 3	2 3					1 3	1 3					1	2	1		1		1			
10 HUMIDITY & MOISTURE	2 1 2		2 1 2	2 1 2	2 1 2		2 2	1		2 1 2	2 1 2		1	3		3	2		2 1 3	2	2			1	1
11 THERMODYNAMIC PROPERTIES OF FLUIDS	4 1 4 4	4 1 1 3	4 2 3 4	2 1 3 3	4 2 4			2 1 3	3 1 2 4	3 1 3 3	3 3 4 3	2 1 3	3 2 3	2 2 1 3		X	3 2 3 3	2 1 2	2 1 3	2 1	2 1 2 3	2 2 4			
12 CRYOGENICS	4 1 4 2	4 1 2	4 1 2	2 1 3	4 1 4	3 1 2	3 1 2	2 1 2	3 1 2 2	2 1 3 2	3 1 4 2	2 1 2	2 3			1	2 3					2 3	2 3		1	
13 ELECTRICITY	1 4 2	1 2 2	1 1 2	3 1 3 2	4 1 4 2			3 1 2	1	3	2		1				2 1 2	1 1 2	2 1 2	2 2 2	2 3 2	2 3 2		1	1
14 ELECTROMAGNETICS	3 2 4 2	2 2 3 2	4 4 2	3 1 3 2	3 1 4 2			3 1 2 2	3 1 3 2	3 1 4 2	3 1 4 1		3 2 3 2							1	3 1 4 1	3 1 4 1	3 4 3	1	1 1 1
15 MEDICAL ULTRASONICS	3		2	2	2 2 2				1		2												2 4 2	2 1 2	
16 ACOUSTICS	2 1 3 2		2 1 3	1 1 2 2	2 1 3			2	2	4	2	1	1	2	3	2	2	2	3	3	3	2		3	1
17 RADIOMETRY & PHOTOMETRY	3 2 3 2	3 2 3 2	3 2 3 2	3 2 3 2	3 2 3 2			3 3 2 2	3 2 2	2 3 2 2	2 3 1 2		2 3 1 2		1	1	1				3 3 2 2			1	1 3 1
18 SPECTROPHOTOMETRY	2 1 3 2		2 1 3	2 1 2 2	2 1 3 2			2 1 2	2 2 1	2 ? 2 3	? ? 2	1 ? 1	1 1 1			2 2 3 2	2 2 3 2	1			2 2 2	2 2 2	2 2 1 2	2 2 2	2 2 3	
19 FAR ULTRAVIOLET RADIOMETRY	2 3 2 1	2 3 1 2	?	2 3 2 2	2 1 3			2 1 2	1 2 2	2 3 2 2	2 3 2 3	1				2 2 1	2 3 2 1						2 3 2 2	2 3 2 1	4 2 2
20 OPTICS	3		2	3	4 3 1	1		2	2	3	2				1		1	2	1	1	2	1	2		
21 LASERS	4 4	3	4 3	3 4	4 4				4 3	4 4	4 4		1		4 1		4 3	4 1	1	3 3	3	4 2	4 1	4 2	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	4 2 4 4			2 3 2	4 4 2					3 4 1	4 3 4						1			3 3 2					
23 SURFACE PROPERTIES	4 2 4 3		2 2 2	3 2 2 1	3 2 3 2			2 2 1 2		3 2 3 3	3 2 3 3						3 2 3 3	3 2 3 3		3 2 3 3				1	
24 IONIZING RADIATION	3 4	3	3	3	2 3			3	3	3	4	1		2		2	2	4		2	2	4	3	4	2
25 AVERAGE	4 1 6 2	3 1 2 1	3 1 3 1	2 1 3 1	4 1 4 2	1	1	2 1 2 1	3 1 2 2	3 1 3 1	3 2 3 2	2 1 1	2 2 1	1	1	2 1 2 1	3 1 2 1	3 1 2 1	2 1 2 1	3 2 3 1	3 1 3 1	2 1 2 1	3 1 1	2 1 1	2 2 1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

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USERS

C D
A
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0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 2. International Metrological Organizations

International Bureau of Weights and Measures (BIPM). International Organization for Legal Metrology (OIML). International Time Bureau (BIH). The national physical standards laboratories and services of other nations.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO INTERNATIONAL METROLOGICAL ORGANIZATIONS — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3	2	2 2	4 2 2	3 2 2	1		3 1 2 2	2 2		4 1 3	4 1 2	1 1 2 2	2 3 2			3 2 3		2 3 1 2		3			3	3 1 2 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3	2 1 3	2 2 1 2	3 2 3	4 3 3 2	4 3		4 2	3 3		3 1 2 3	4 3	3 2 3 2	1 1 3	1		2 1 3 2	X	4 2 2		1			4	3 1 3 1
3 OCCUMENTARY STANDARDIZATION ORGANIZATIONS		2 2 1	2 2 1	3 2 3 2	3 1 4 2	2 3		3 2 2			3 1 1	4 2	2 1 2	4 2 3 2			4 2 3 2	X	?					4	3 1 2 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 2	2 1 1	2 2 1	3 2 1 2	2 2 1 3	1		4 2 1 1	2 2		2 1 1 2	2 1 3	3 1 1 2	3 2 2 1			4 1 2 2	X	2 1 2		1			2	2 1 1 1
5 NBS	3 1 4 2	3 1 4	2 3 1 2	3 2 2	4 1 4 3	2 4		3 2 1 1	4 2 3 2		4 1 3 2	4 1 2 2	3 1 3 2	3 2 3 1	2 4		3 1 3 2	X	2 3 3 2		4 2			3 2 4 2	3 1 3 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	3 3											3 1 2													1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					2 2 1 1	1																			1
8 STANDARDS & TESTING LABORATORIES AND SERVICES																									
9 REGULATORY AGENCIES (excl. OWM's)																									
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)																									
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)					2 2 2 2																				
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																									
13 INDUSTRIAL TRADE ASSOCIATIONS		2			2 2 1 2																				1
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)																									
15 CONSTRUCTION (SIC Div. C)																									
16 FODD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 2D-26, 31)																									
17 CHEM/PETROL/RUBBER/ PLASTICS/STDNE/CLAY/ GLASS (SIC 28-30, 32)					2 2 1 2																				1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)																									
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)					2	2																			1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)																									
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)																									
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)																									
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)																									
24 HEALTH SERVICES (SIC Major Gp 8D)																									
25 GENERAL PUBLIC																									

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF INTERNATIONAL METROLOGICAL ORGANIZATIONS / USERS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (DIAM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (except DIAM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. DIAM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY	1	3		3	3 3	3 1		1	2	2	2			4 1								4 1			
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1	2 1 3	2 2 1	2 1	3 1 2																				
3 VIBRATION & SHOCK	2 1 2	2 2 1 1	1	2 2 1	2 2 1																				
4 SURFACE FINISH	2 1 1	3 2 3 2	3 1 3 2	3 2 2	3 1 2 2					1			2					1							
5 MASS, VOLUME & DENSITY	1	4 3 3 2	3 3 2	2 4 2 4	3 2 3 4		2 4 1 4												2 4 2 4						
6 FORCE		4 3	3	1	4 3														2						
7 FLUID FLOW																									
8 PRESSURE	3 1	4 2	2 1 2	3 2 2	4 1 2																				
9 TEMPERATURE	3 2	3 3	1 1		3 1 3																				
10 HUMIDITY & MOISTURE																									
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 1 1 3	3 1 2 3	2 1 2 3	3 1 2 2	4 1 3 3																				
12 CRYOGENICS	4 1 1	4 3	4 1 2	2 1 2	4 1 2 2	3 1 1 2							3 3 1 3												
13 ELECTRICITY	1 1 2 2	3 2 3 2	1 1 2 2	3 1 2 2	4 2 3 2																				
14 ELECTROMAGNETICS	2 2 2 2	1 1 3	1 1	2 2 1 1	2 2 2 1																				
15 MEDICAL ULTRASONICS		1			1																				
16 ACOUSTICS																									
17 RADIOMETRY & PHOTOMETRY	3 1 2 2	2 1 3 2	4 1 3 2	2 2	3 1 3 2																				
18 SPECTROPHOTOMETRY	1 2	x	1 1 2 2	1 2 2	2 2 2			1 2 1 2	1 2				1 3 1 2												
19 FAR ULTRAVIOLET RADIOMETRY	2 3 1 2	4 2 2	?	1 2 1 2	2 3 2																				
20 OPTICS																									
21 LASERS	1	1			1																				
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPEPTIES																									
24 IONIZING RADIATION	2	4	3	2	4																				
25 AVERAGE	2 1 1	3 1 3 1	3 1 2 2	2 1 1	3 1 2	1			1	1	1			1					1			1			

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USERS

C D
A
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0 = No improvements needed
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A - MAGNITUDE OF TRANSACTIONS

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1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 3. Documentary Standardization Organizations.

American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) and their affiliated organizations. International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC). The documentary standards committees of the International Telecommunications Union and its subsidiaries, of the International Scientific Unions, and of other international technical agencies. National Council on Radiation Protection and Measurements and its international counterparts. The documentary standardization committees of domestic and international professional, scientific, technical, and industrial trade organizations. The standardization activities of the U.S. Department of Defense. Note that governmental regulatory agencies are covered in sector 9.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO DOCUMENTARY STANDARDIZATION ORGANIZATIONS — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY 1	LENGTH & RELATED DIMENSIONAL MEASUREMENTS 2	VIBRATION & SHOCK 3	SURFACE FINISH 4	MASS, VOLUME & DENSITY 5	FORCE 6	FLUID FLOW 7	PRESSURE 8	TEMPERATURE 9	HUMIDITY & MOISTURE 10	THERMODYNAMIC PROPERTIES OF FLUIDS 11	CRYOGENICS 12	ELECTRICITY 13	ELECTROMAGNETICS 14	MEDICAL ULTRASONICS 15	ACOUSTICS 16	RADIOMETRY & PHOTOMETRY 17	SPECTROPHOTOMETRY 18	FAR ULTRAVIOLET RADIOMETRY 19	OPTICS 20	LASERS 21	PHYSICAL PROPERTIES OF ATOMS & MOLECULES 22	SURFACE PROPERTIES 23	IONIZING RADIATION 24	AVERAGE 25
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)		1 1	2 2	4 3 2	2 3 2	2	2 4	3 3 2	1	2 1 2	4 2 4	4 1 2	1 1 2	4 2 2	2	2 3	3 2 3 2	2 1 3	?	2	4 3		2 2 2	3	3 1 3 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS		2 2 1	1 1	3 1 3 2	3 3 3 2	3		2 1 2	1 1		2 1 2 3	4 1 2	1 1 1 2	1 2			4 1 3 2	1 1 2 2	?					3	3 1 2 2
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS		2 1 3	2 2	4 2 3 2	2 1 2	3	4	2 3 1	3 3 2	2 1 3	4 1 2 1	4 1 3	3 2 3 3	2 2 3 2	3	2 3 2	3 2 4 2	2 2 2	?	3	2		1	4	3 2 3 1
4 INSTRUMENTATION INOUSTRY (SIC Major Gp 38)		2 1 1	2 2 1	4 2 2	2 1 2	2	4 2	3 2 1	4 3 2	2 1 3	2 1 1 2	3 1 3 2	2 1 4 2	3 2 3 2	2	2 1 2	2 1 3 2	2 3 2	?	4 3	2		2 1 2	2	2 1 2
5 NBS		2 1 2 2	2 2 2 2	3 1 3 2	2 1 3	2 3 2	2	3 2 2	2 1 3 2	2 3 2	4 2 3 1	4 1 3 2	2 1 3 2	2 2 2 1	2 2	2 3 1	2 3 2	1 3 2	?	2 2 1	4 3		3 1 2 2	3 3 4 3	3 1 3 2
6 OTHER U.S. NATIONAL STANOARDS AUTHORITIES												3 1 2								1					
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)		2 1 1			2 1 2 1	1				2 2 1		3 1 3 2													1
8 STANDAROS & TESTING LABORATORIES ANO SERVICES		2 1 1 1	2 2 1 2	3 1 3	1 1	2 3 2	2	2 2	2 2	2 2		2 1 2 2	2 1 3 2	3 2 3		3	2 1 2 2	2 2 1 2	?	2			2 2 1 2	1	2 1 2 1
9 REGULATORY AGENCIES (exc. OWM's)			2		1	3 2 4 2	1		1		3 1 4 2		2 1 3	3 2 3	2	1	2 1 1 2	2 2 1 2	2 2 2	1 2	1 2 4			4	3 1 2 2
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		2	1	3 3	1 1 1	2 3 2	2 2	2	1	2 1 2	3 3 1	3 1 2	2 1 2	3 2 3	2	1	2 1 2	2 1 2	?	2	1		2 2 1 2	2	3 1 2 1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		2	2 2 2	3 3 2	1	2 4 2	2	3 2	1	2 1 3	3 3 4	2 2 2	1 2 2	2 3 1		2	2 1 1	2 1 2 2	?	1	3 2		2 2 1 2	4	2 2 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)						1	3					2 2 2						2 2 1 2						1	1
13 INDUSTRIAL TRADE ASSOCIATIONS		3		3 3	2 3 1	2 4 2	3	2	2 2		2 1 3	2 3 2	3 4 2	1 2 3 2		2 3 2	2 1 3 2	2 2 2			1				2 1 3 2
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)		2 1 2			2 2	2 1	2 1 3 2	2	3 1 1	2		1												2	2 1 1
15 CONSTRUCTION (SIC Div. C)		1				2 1	1	1	1	1			1			3	1			1	1				1
16 FOOO/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				4 2 3 2	1	2 3	1	1	3 1 2	2	x	1						2 3 2	?		2			1	3 1 1 1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)				2 1 2	2 2	2 2	2	2 1	3 1 3	1	2 3 3	3 2 2	2 1 2					2 3 2	?	2	2		2 1 2	3	2 1 2 2
18 PRIMARY & FAB. METAL PROOUCTS (SIC 33-34, 391)		2 1 3		4 3	1	2 3		2 1	3 1 3	1			2 1 2					1		2	2		2 1 2	4	3 2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 2	1	4 3	3	2 3	1		3 1 2	1		1	2 1 2			4 1 3					1				3 1 2
20 ELECTRIC ANO ELECTRONIC EQPMT (SIC Major Gp 36)		2 1 1	1	4 1 4 2		2 1		2 1	3 1 1	1			2 1 3 2	1 3 1		2	2 4 2	2 3 2		2	3		2 1 2	2	3 1 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2 1 2	2 2 3	3 2 3	2	2 3	1	2 1	3 1 2	1		2 3 2	2 1 3 2	2		3	1	2 3 2		1	1		2 2 1 2	2	2 1 2 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)			1		1	2 2	2 3 2	2 1	3 1 1			2 3 2	3 1 3 2	2 1 3					?	3	1			4	2 1 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)					2	2 2			3 1 1			1						2 3 1 2		1	2			3	1
24 HEALTH SERVICES (SIC Major Gp 80)				3 2 2					1	1			2 2 2		2	1	1	2 2 2	?	2	2			3	1
25 GENERAL PUBLIC																								2 R	1 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF DOCUMENTARY STANDARDIZATION ORGANIZATIONS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-n, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY																								
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1	2 2 1	2 1 3	2 1 2	2 1 2		3 1 1	3 1 3		2	2		2	2 1 1	2	1	1	2 1 4	2 1 4	2 1 3	2 1 3	1	1		1
3 VIBRATION & SHOCK	2 2	2 2 1	2 2 2	2 2 2	2 2 1			2 2 1	1	2 3	2 3							2 3 2	2 2 2	2 2 2 1	2 2 1 2			
4 SURFACE FINISH	2 1 2 2	3 2 3 2	4 2 3 2	4 2 4 3	4 2 4 3 2			3 2 3		3 2 3	3 1 2 2		3 2 3			3 3 2 2	3 2 2	3 2 3	3 1 3	3 1 3			3 3 3	
5 MASS, VOLUME & DENSITY	1	3 1 4 2	2 1 3 2	3 1 3 2	2 3		3 1 2	4 3	1	1 1 1	1		1	X		2 1	2 1	3 1 3 2		1	1	2	2 1	1
6 FORCE	1	2 3	3	3 2	3 3 2		1	3 3	3 3	2 3	2 3	3 2 2	3 4 2 R	3 2 2	3 2 2	3 4 2	3 3 2	3 4 2	3 2 2	3 4 2	3 3 2	3 1 2		4 2 2
7 FLUID FLOW	1		4	3 1 3 2	2 1 2			2 1 2	3 2 2	2	2	2	2 1 3 2	2 3 2	2 1 2		2 3	1	2 1 3 2	2 1 3 2	2 1 3 2			
8 PRESSURE	1	3 2 2	2 1 3 1 2	3 3 2	2 3		1 1 1	2 1 2	3 2	1	3 1 1	1	2 3	1		1	2 1 1	2 2	3 1 3		2 2 1			2 2 1
9 TEMPERATURE	1		3 3 3 2	2 1 3 2	1 1 1 2					1	1		1 1 2		1	1	1	1	1		1		1	1
10 HUMIDITY & MOISTURE	2 2 1		2 1 3	2 1 2	2 2 1		2 2 2	3		3	2		1	3 1 3 2	2	3 1 4 2	2 1 3	1	2 1 3	2 1 3 2	2 2		?	
11 THERMODYNAMIC PROPERTIES OF FLUIDS	4 1 2 1	3 1 1	4 1 2 1	2 1 2	4 1 2 1			2 1	3 2 1	3 1 2 1	3 2 1	2 1	3 2 1	2 1		X	2 2 1	2 2 1	2 1	1	1	1 2		
12 CRYOGENICS	4 1 1	4 2	4 1 3 2	3 1 3 2	4 1 3 2	3 1 1 2	3 1 2	2 1 2	3 4 1 2	3 1 2	2 1 2	2 2	2 1 3 2			1	2 3 2	1		2 3 2	2 3 2	1		2 1 2
13 ELECTRICITY	2 1 1 2	2 1 2	3 2 3 2	2 1 3 2	2 1 2			2 1 2	2 1 2	2 1 2 2	2 1 2		2 1 2		1		2 1 1 2	2 1 2 2	2 1 4 2	2 1 3 2	2 1 3 2		2 2 2	1
14 ELECTROMAGNETICS	4 2 2 3	4 2 3 2	2 2 3 2	3 2 3 2	2 2 3 1			2 2 3 1	3 2 3 3	4 2 3 1	2 2 3 1	2 2	4 2 3 2						2 2 4 1	4 2 4 3	1	1		
15 MEDICAL ULTRASONICS	2		3	2	2				2				?									3		
16 ACOUSTICS	1		2 2 3 2	2 1 3 1	2 2 4 2			2 1 3	2 3 2	x	2	1	3 2 3 2	1	2 1 4	1	1	1	2	3	2 1 4	1		3	
17 RADIOMETRY & PHOTOMETRY	4 3 3 2	4 2 3 2	3 2 4 2	2 3 2 2	4 2 2			3 2 1 2	2 1 1 2	2 1 2 2	2 3 1 2		3 2 1 2		1					2 3 3 2	1			1	
18 SPECTROPHOTOMETRY	2 1 1	X	2 2 2 2	2 3 2	2 2			1 3 2 2	2 3 2 2	2 ? 2	2 3 2 2	2 2 2	2 2 2			2 3 2 2	2 3 2 2			2 3 2 2	2 3 2 2	3 2 1 2	2 3 2 2	2 2 2 2	
19 FAR ULTRAVIOLET RADIOMETRY	?	?	?	?	?			?	2 3 1 2	?	?					?	?			?	?	?		?	?
20 OPTICS	2		3	4 3	3 3 1	2		3	3	2	2				2		2	3	2	1	3	2	2	1	
21 LASERS	1		2	2	2				1	1	1	1	1		1	1	1	1		2	1	2	2	2	1
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																								
23 SURFACE PROPERTIES	2 2 1 1		1	2 1 1	3 2 1			2 2 1		2 2 1 1	2 2 1 1						2 2 1 1	2 2 1 1		2 2 1 1	2 2 1 1			
24 IONIZING RADIATION	2	4	4	3	4			3	4	2	4	3		2		2	4	4		3	2	4	3	4	2
25 AVERAGE	3 2 1 2	3 1 2 2	3 2 3 1	3 1 3 1	3 1 2 2		3 1 1 1	3 1 2 2	3 2 2 2	3 2 1 1	3 1 2 1	1	3 1 2 2	1	2	2	2 1 2 1	2	2 2 1 1	2 1 2 1	2 1 2 1	3 1 2 2	1	2	1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 4. Instrumentation Industry (SIC Major Group 38).

Instruments and related products--engineering & scientific instruments, environmental controls, process control instruments, fluid meters & counting devices, instruments to measure electricity, other measuring & controlling devices, optical instruments & lenses; surgical, medical and dental instruments, appliances, equipment, and supplies; opthalmic goods; photographic equipment & supplies; watches, clocks, & watchcases. Note that scales and balances, except laboratory, are included in sector 19; x-ray apparatus and tubes in sector 20; and machine tools in sector 19.

The instrumentation industry is, of course, a major, essential supplier sector in the system. In addition, it is substantially measurement intensive in its own right, so that this sector is also a major user. The quality of many of the measurements made within this industry is unusually important, since it will limit the quality of all of the measurements made with the products of this industry, which is to say, the quality of almost everything that happens in the national measurement system.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO INSTRUMENTATION INDUSTRY (SIC 38)

SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof, Soc. & Publ.)	2	1 2	2 1	4 3 2	2 2 N	2	2	2 3	1 3	2	2 3 3	2 3	3 2	3 2	2	1 2	3 3 2	2 1 2	2 3 2	3	3 4	2 3 2	3 2 3	3	2 1 3 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3	2 1 1	2 2 1	3 2 2	2 4 4	1		3 2 2			3 1 2	2 1 2	3 1 2	2 2 1			2 2	1 2 2	1 2 2					2	2 2 1 1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 2	2 2 2	4 2 3	3 1 3 2	3 2	3 1 3 2	3 3 2	2 1 3 2	2 1 2	2 1 1 2	3 1 3 2	2 1 3 2	3 2 3	2	2 3 1	2 3 2	2 3 2	?	4 3	2		2 2 1	3	3 1 3 1
* 4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 3	2 1 3	2 2 2	3 1 2	3 1	2 3 1	2 4 2	4 1 4 4	4 1 4 2	2 1 2 2	2 1 2 2	2 3	4 2 4 3	4 2 4	2	2 3 2	4 1 4 2	2 3 3	2 2 2	4	3	2	1 1 3	3	4 1 5 2
5 NBS	3 1 3	3 1 3	2 2 2	2 1 2 2	2 1 2 1	3	3	3 2 4	3 3 2	3 1 3	3 1 3 2	3 1 3 2	4 1 4 3	3 2 4 1	2 3 2 3	2 1 3 4	3 1 4 2	1 3 2 2	2 2 2	3 1 3	4 2 4	2 2 2	3 2 2	3 1 4 3	3 1 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2 2											3 1 1 2								1					1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (DWM's)	1 R	1 1 2 R			3 1 2 2 R					2 2 2 R		3 1 2 2 R	2 1 2 R												3 1 1 1 R
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 ? 3 ? R	2 1 2 2 R	2 2 2 R	2 2 R	1 2 R	3 2 3 R	2 1 3 R	2 2 3 R	2 3 R	1 R		2 3 R	3 1 4 2 R	3 2 4 R		2 1 3 2 R	2 2 3 2 R	2 1 3 2 R	1 1 2 R	1 R	1 R		2 2 1 2	3 3 2 R	2 1 3 1 R
9 REGULATORY AGENCIES (excl. DWM's)	2 R		1 R		1 R	2 ? 2 ? R	2 R	3 3 R				3 1 2 2 R	3 1 3 3 R	2 2 3 R	2	2 R	3 1 3 2 R	2 3 1 2 R	2 3 2 R	2 R	1 2 4			3	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 ? 3 ? R	3 1 R	3 R	3 R	2 1 N R	3 2 2 R	2 R	2 2 R	2 R	2 1 2 2 R	2 1 2 1 R	2 2 2 R	3 1 3 4 2 R	3 1 4 2 R		2 2 4 2 R	2 1 2 2 R	2 2 2 R	1 2 R	4 R	3	2 3 2 2	3 2 2	3	3 1 3 2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 R	2 2 1 R	1 R	2 1 2 R	2 1 R	2 R	2 R	2 2 R	2 R	2 1 2 3 2 R	2 1 2 2 R	2 2 R	2 1 2 4 2 R	2 2 4 2 R		2 1 2 3 1 R	2 1 2 2 2 R	2 2 2 1 2 R	2 2 1 R	3 3 R	3 2 3 2	1 3 2 2	3	2 1 2 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. DWM's & Reg. Ag.)		1 R				1 2 R	2 R		1 R			2 1 R	2 1 2 R				1 1 1 R		1 R	1 R	R			1 R
13 INDUSTRIAL TRADE ASSOCIATIONS		3 R		2 3		?	3 R	2 3 1 2 R	1 R	1		2 3	3 1 4 3 2	3 2 2 R		2 1 3 2 R	2 1 4 2 2 R	2 2 2 R			1			2 1 2 2
14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	2 ? 2 ? R	2 R					2 R	3 R	3 2 2 R	2 2 R						2 R							2 R	1 R
15 CONSTRUCTION (SIC Div. C)		1 R			1 R	1 R	1 R	1 R	1 R	1 R			1 R			1 R				1 R	1 R				1 R
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 2D-26, 31)				3 2 2 R	1 R	3 R	1 R	2 R	3 2 2 R	2 2 R	X		1				2 2 2 2 2 R	2 2 1 2 R		1 R			1 R	3 2 1 2 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 2B-3D, 32)				1 R	1 R	2 R	1 R	1 3 R	3 2 3 2	I	2 1 2 R	1 3 R	3 1 1 2 R			2 R	2 2 2 3 2 R	2 2 2 2 R		1 R	2 R		3 2 2 2	3 R	2 1 2 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2 1 2		3 3 R		3 R		1 R	3 2 3 2 R	1 R			3 1 1 2 R			2				I R	1 R		3 2 2	4 R	3 1 2 1 R
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 I 3 R	1 R	3 R	3	2 1	1 R	1 R	3 2 2 1 2 R	2 R			3 1 3 2 R			2 R				1 R	1 I R				3 1 2 1 R
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	4	2 1 2 R	I R	3 2 3 R		1 R		2 R	3 2 2 R	1 R			3 1 4 2 R	3 2 4 3 R		2 R	4 1 3 2 R	2 2 2 R	2 1 2 R	3 R	3 R	2 3 2	3 2 2	2 R	3 1 3 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2 R	2 1 3 2 R	2 2 2 R	2 1 2 R		2 R	2 1 3 R	2 R	3 2 2 1 2 R	2 R		1 3 R	3 1 3 4 2 R	3 2 4 2 R		1 R		2 2 2 R	1 R	1 2 R	R		3 2 2	2 R	3 1 2 1 R
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 1 3 ?	1 R	1 R		I R		2 1 4 R	2 2 R	3 2 2 R			1 3 R	2 I 3 4 2 R	3 2 4 2 R				2 1 2 R		2 R	2 R			3 R	2 2 1 R
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	3 R	2 1 1 R	1 R		3 R	1 R		3 R	3 2 1 2 R				I R	1 R		1 R	1 2 2 2 R	2 2 R		2 R	2 R				2 R
24 HEALTH SERVICES (SIC Major Gp 80)	I R	I R		2 2 2 R	2	1 R	1 R	I R	3 R				3 2 2 R	1 R	3 R	3 R	1 R	2 3 2 R	1 R	4 R	2 R			4 R	2 R
25 GENERAL PUBLIC	2 ? 4 ? R	1 R			1 R	I R		2 1 R	2 3 1 2 R	1 R			1 R				2 1 2 R			1 R				1 R	2 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF INSTRUMENTATION INDUSTRY (SIC 38)

USERS

MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Tech.) 1	INTERNATIONAL METHOLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 5	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 6	STANDARDS & TESTING LABORATORIES AND SERVICES 7	REGULATORY AGENCIES (excl. OWM's) 8	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 9	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds. Labs & Reg.Ag.) 10	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 11	INDUSTRIAL TRADE ASSOCIATIONS 12	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 13	CONSTRUCTION (SIC Div. C) 14	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 15	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 16	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 17	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 18	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 19	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 20	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 21	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27) 22	HEALTH SERVICES (SIC Major Gp 80) 23	GENERAL PUBLIC 24
1 TIME & FREQUENCY	2	2 1 2		3 3	3 1 3 1 3 2	1	3 1 3 2	2	3 4 2 2	3			3 3	1	2	2	2	2	3	2	2 4 2 1	4	2	4
2 LENGTH & RELATED DIMENSIONAL MEASUREMENT	1 1 2 2	1 2 1 1	2 1 1	2 1 3	3 1 2	1 2	2 1 2		4	3	2	2	2 4	3	2	2 1 3	2 1 4	2 1 3	2 1 4	2 1	2 1	3	1	3
3 VIBRATION & SHOCK	2 2 2 2 2 2 1 1 1	1		2 2 2	2 2		2 1 2	2	2	2 2 1						1	2 1 1	3 2 2 2	3 2 3	2 2 1 2	1			
4 SURFACE FINISH	3 2 3 2 4 2 3 3 2 2	1 2 2		3 3 2 2	3 1 2		2 1 2		2 1 2 2	1 2 2		3 1 3			2 2 1 2	2 1 2 1	2 1 3	1 3 3	1 3 1 3			?		
5 MASS, VOLUME & DENSITY	1 2 2 2 2 1 2 3	2 1 2		1 3	2 3 2	2 1 2 2	2 1 3 2	2 2	2 2	2 1 2	1			1 1		2 3 2 2	2 2	1	2	1	2	1	3 1	3 3	2
6 FORCE	2	1 2		2 3 1	1 2		1 2	2	1 2	1 2	1 2	?	3 1	3 1	2 3	2 2	2 3	2 3 1	2 2	2 1	2	1	2 1	1	2 1
7 FLUID FLOW	2 1 2	2 4		2 4 2	4 1 3		4 3 1	4 3 2	2	2	3	2 2	3 3 2	2 1 4	2	3 3 2	1	1	1	3 3 2	3 4 2		1	1
8 PRESSURE	2 4 2 3 2 1 2 1 1			4 1 4	2 2 2		2 3	3 3	2 4	3 4 2	2 2 1	2 1 1	3 1 2	3 1 1	3 1 2	3 1 4	2 1 3	3 1 4	3 2 4 1 3	4 1 4 1 4	4 1 4	3 1 3 1	2 1 2 1	
9 TEMPERATURE	2 1 2 1 4 3 2 2 2	2 3		4 1 4 2	3 1 3 2		2 1 3 2	2 1 2	4 1 4 2	4 1 4 2	2 1 2	4 2	4 1 3	4 1 4 2	4 1 4 2	4 1 4 2	4 1 4 2	4 1 4 2	4 1 4 2	4 1 4 2	4 1 4 2	4 3 4 2		
10 HUMIDITY & MOISTURE	2 1 1	2 1 3		2 1 2	2 1 2	3 2 2	3		4	2 3 1	1		3 2 4 2	3 2 2	2 1 3	3 1 2	3 1 2 2	2 1 2 2	2	1	1	1		
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 1 2 1 2 1 2 2 2	1 2 1 1		2 1 3 2	1 2		2 1 2 1 1	1 2	2 1 2 1	1 1		2 1 1	1 1 2		x	2 1 3 2		2 1 1		1 1				
12 CRYOGENICS	2 1 2 1 3 1 2 3 3			2 3	3 1 3 1 3 2 2		3 2 3 2	3 2	3	3 3 1		3	1 1	1	1	4	2	1	1 2	1	3	1		
13 ELECTRICITY	2 1 3 2 3 1 4 2 2 2	2		4 2 4 3	3 2 4 3	3 1 3 1 3 1 2 2 2	3 1 4 3	3 1 3 2	3 4 2	3 1 3 2	3 1 2	2 1 2	1	2	1	3 1 3 3	3 1 3 3	3 1 3 3	3 1 4 2	3 1 3 2	4 1 2 3	3 2	2	
14 ELECTROMAGNETICS	2 2 1 2 2 3 3 2 2 1	2 3		4 2 4 1	4 2 4 2		3 2 4	2 3 3	3 4 2	1 3 4	2 1	2 2 2	2		1	1	1	2	3 2 4 2	2 3 4	3 2 4 3	1	1	
15 MEDICAL ULTRASONICS	2	2		2	2 3 1			1		2												3		
16 ACOUSTICS	2 1 3 1	2 2		2 3 2	2 1 3		3 2 3	2	3 4 2 3	3	2	2 1 3 2	3	3	3	3	3	3	3	3	2	1	3	
17 RADIOMETRY & PHOTOMETRY	3 2 3 2 4 2 2	2 3 2		4 1 4 2	4 1 2		4 1 2 3 2 2	4 1 3 2	4 1 3 2	4 1 3 2	1	3 1 3 2		1	1	1			4 1 3 2	1		3	1	4 3 2
18 SPECTROPHOTOMETRY	2 1 3 2	x 2		2 3 3	2 1		2 1 2 2	2 3 1 2	2 2 2	2 2 2	3 2 2	2 1 2	1			2 3 2 3 4 1	2 3 2	2 3 2 2	2 3 2 2	2 2 1 2	2 3 2 2	2 2 3 2		
19 FAR ULTRAVIOLET RADIOMETRY	2 2 2 1 2 2 ? 1			2 2 2	2 1 2		2 1 2 2	2 1 2 2	2 2 2	2 2 2						2 2 1 3	2 2 2 2		2		2 2 2	2 2 2		
20 OPTICS	2 3	3		4	4 1 3 1 1		3	2	4	4	2			3		2	3	2	4	3	4 4 2	4 2	4 1 4 2	
21 LASERS	1	1 2		3	2		1	3	4	3	1	3		1	1	2	1	1	3	2	2	2	1	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	2 2 2			2	2 2				3 3 2	3 2						1			3 2 3 2				
23 SURFACE PROPERTIES	3 1 3	2	1	3	3 1 2		3 1		3 3 2	1 3 3	1					3 1 3	3 1 3	3	4	1 3 3		1		
24 IONIZING RADIATION	3	2	2	3	4		3	3	4	4	1		3		2	4	4		3	3	4	2	4	1
25 AVERAGE	2 1 2 1 2 1 2 2 1 2	1 2	1 2	4 1 5 2	3 1 3 2	1	3 1 3 2	3 1 2	3 1 5 2	3 1 5 2	4 3	2 1 2	3 1 3 2	4	3	3 1 3 2	3 1 3 2	3 1 3 2	3 1 4 2	3 1 3 1 5 1	3 1 5 1	3 1 5 1	3 1 4 2	3 4 2	1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, x = Not studied, Blank = 0

Sector 5. NBS

The National Bureau of Standards--all Institutes and divisions. NBS has been entered as the fifth standard supplier-user sector, since it occupies a key role between the basic technical infrastructural sectors preceding it and the dissemination institutional sectors following.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO NBS — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENT	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 3	1 1 2	2 2 2	4 1 3 2	4 1 3 2	2 3	4 3	3 3	2 3	2 1 2	4 2 4 4	4 1 4	4 1 4 2	3 1 4 2	2 2 2	2 1 3	3 2 3 2	2 1 3	4 2 3 1	4 3	4 4	4 4 2	3 2 3 3	2 3	4 1 4 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 1 3	3 1 2	2 2 1	3 1 2 2	3 2 3 4	4 3		4 2 1 2	3 1 3		4 1 3 3	4 1 2 2	4 2 3 2	2 2 2 1			3 1 3 2	2 2 2 2	2 3 2 3		1			4	3 1 3 2
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 2	2 2 1	4 2 3 2	2 3 3	3 3 2	2 2	2 3	1 1 1 2	2 2 1	4 1 2 1	4 1 3 2	2 1 1 2	2 2 1 3	2 2 2	4 2 4 2	4 2 2 2	2 2 ? 2	3 3 1	3 2 2 1		3 2 1	4	3 1 3 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 1 3	3 1 2	2 2 2	3 1 2 2	2 1 3 2	1 2	4 1 3	2 2 2	3 1 3 2	2 1 2 2	3 1 3 2	3 1 3 2	3 2 4 3	4 2 4 2	2 3 1 2	2 1 3 2	4 1 2 2	2 1 1 2	4 1 3 1	4 1 2	2 2 2	3 1 2 3	4	3 1 3 2
* 5 NBS	3 4	2 1 3 2	2 2 1 2	3 1 2	4 2 3	2 4	3 1 3 2	4 3	2 3 2	2 1 2	4 1 3 1	4 1 4 2	4 1 4 3	3 1 4 1	2 1 3	2 1 3 2	4 1 3 2	1 1 2 2	4 2 2	3 1 2	4	3 4 4	3 2 3 2	4	3 1 4 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	3 1 3											3 2 1 2								2 1					3 1 1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	3 1 1 2 R	2 1 1 R			4 1 4 R	1 R		1 1 R	1 1 2 2 R	2 3 R		3 1 2 2 R												4 1 2 1 R
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 1 2 R	3 2 2 2 R	2 2 2 N R	4 1 3 2 R	2 2 R	1 2 R	2 1 3 R	1 1 R	2 2 1 R	2 2 1 R		2 2 2 R	2 2 3 2 R	3 1 4 2 R		2 1 2 R	3 1 2 2	2 1 2 2	2 2 2 2	2 2 1 R			2 2 1 2	1	3 1 2 2 R
9 REGULATORY AGENCIES (excl. OWM's)	3 2 R		2 2 1 2 R			2 2 4 2 R	3 1 3 R		2 4 1 2 R			2 1 1 2 R	2 2 2 3 R	3 2 3 1 R	3 3 2 1 R	3 3 1 2 R	3 1 2 2	2 1 2 2 R	2 1 2 2		2			4 3 4 4 R	3 2 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 1 2 2 R		2 2 1 N R	3 1 2 R		2 4 2 R	2 2 R	2 3 1 R	1 1 2 R	2 3 1 R	3 2 3 2 R	3 2 4 2 R	2 2 2 2 R	2 1 3 1 R		1 2 R	2 1 1 2	2 1 2 2		1 3 R	3 3	2 3 3 3	3 2 3	3	2 1 3 1 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 1 3 2 R	1 R	2 2 1 2 R	3 1 2 R	2 2 R	2 4 2 R	2 2 R	2 2 2 R	2 1 2 2 R	1 3 2 4 R	2 3 2 R	2 1 4 2 R	2 2 2 1 2 R	2 2 3 1 R	2 2 3 1	3 2 3 R	3 1 2 2	2 1 2 2	2 2 1 2	2 2 R	3 3	4 2 4 2	3 2 3	4	3 1 3 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)						2 2 R						2 1 2 R	2 1 2 R			1 R		2 2 1 2			1 3 1 2 R				2 1 1 R
13 INDUSTRIAL TRADE ASSOCIATIONS		3		3 1 3 2 R	2 1 2 R	2 2 R	2 1 2 R	2 1 2 R	2 2 R	1 2 3	2 1 4 2 R	2 1 3 2 R	2 1 2 2 R	2 1 4 1 R	1	3 1 4 2	2 1 2 2			1 R				2 1 2 2
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	2 1 2 R	3 1 2 R			3 1 R		2 1 2 R		3 3 2 R	2 2 3 R	1 2					1 R									2 2 1 R
15 CONSTRUCTION (SIC Div. C)						2 2 1 R	2 1 R									3 R	1 R			3 2 R	1 R				1 R
16 FODD/TDB/TEXTILE/ APPAREL/LBR/FURN/PAPER LEATHER (SIC 2D-26, 31)		1 R		4 1 2 R		1 2 R		1 R	3 3 2 2 R	2 X R								2 2 2 R			1 R			1 R	3 2 1 2 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STDNE/CLAY/ GLASS (SIC 28-30, 32)		2 1 1 R		2 1 1 R	3 1 2 1 R	1 2 R		2 1 R	3 3 4 2 R	1 2 3 R	2 3 2 1 2 R		2 1 1 2 R					2 1 2 R	1 3 1	1 1 R	1 R		3 2 2 3	3	3 2 2 R 2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		3 1 2 R		3 2 2 R		1 2 R		2 1 R	3 3 2 R				2 2 2 R							2 1 1 R	1 R		3 2 3	3	3 2 1 R
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		3 1 3 R	2 1 R	3 2 1 2 R	3 2 R	2 3 R			3 3 2 R	1 R			1 R			3 R				2 1 1 R					3 2 R
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1	3 1 3 2 R	2 1 R	3 1 2 R	2 R	1 2 R		2 1 R	3 3 2 R	1 R			2 1 2 1 3 2 R	3 1 R		2 R	4 1 3 2	2 1 1 2 R		1 R	1 R	2 3 2	3 2 3	2	3 1 2 R 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1 R	2 1 2 R	2 2 1 R	3 3 1 R		2 2 3 R	2 1 3 R	2 2 R	3 3 1 R	2 1 N R		2 1 3 2 R	2 1 3 2 R	3 3 R		2 1 2 R		2 1 2 R		2 1 1 R	1 R		3 2 2		2 1 2 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3 1 4 2		X			2 2 R	3 1 2 R	2 1 R	3 3 2 2 R			2 1 3 2 R	2 1 4 3 R	2 2 3 R		3 R			2 1 1	3 2 R				3	2 1 2 2 R
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1 R	2 1 1 R				1 1 R			3 3 1 2 R				3 1 R					2 1 2 R		3 2 1 R				3	3 1 1 R
24 HEALTH SERVICES (SIC Major Gp 80)				3 2 2 R					3 R				2 1 2 R	3 R		2 R		2 1 2 R			1 R		4 2 4 3	4 2 3 R
25 GENERAL PUBLIC	2 1 2 R	1 1 1 R	2 2 1 R			1 1 R		3 2 1 R	1 R			1 2 1 2 R				1 R	3 1 2 R			1 1 R	1 R			1	2 1 1 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF NBS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 [illegible]	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg. Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETRLE/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRONIC AND ELECTRIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, ba) 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY	2 3	3 1 4 2		3 1 3	3 4	3 1 3	3 1 2	3 3	3 3	3 ? 4	3 3	1		4 4								1	1	3 1 4	3		2 3
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 1	3 1 4	2 1 2 2	2 1 3	2 1 3		3 1 1 N	3 1 4		1	1		3	4 4 1 2	1		3 1 3	3 1 4			3 1 3 2	3 1 3 N	1	3 1 1 N		1 1 1
3 VIBRATION & SHOCK	3 2 2 2	2 3 1 2	2 2 2	2 2 2	2 2 1 2			2 1 2	1	3 1 1 N	2 1 2									2 3 1	2 3 1 1	3 2 2	2 2 1		2 3 1
4 SURFACE FINISH	3 1 2 2	3 2 2	3 1 2 3 2	2 1 2	3 1 2			3 1 2		3 1 2 N	2 1 1		3 1 2			3 1 2 1 2	2 2 1 2	2 1 1 2	2 1 2	3 2 2 2	2 1 2		2 2 2		
5 MASS, VOLUME & DENSITY	4 1 4 4	4 1 4 3	2 1 3	2 1 2 1	4 2 3		4 1 4 2	2 2	3 1 3	1 2 N	2 1		2 1 1	2 2		2 1 2	2 2 1		2 1 1				1 2 N		
6 FORCE	2 3 2	2 4	2 3 2	3 3	2 4		1 1	3 3	3 3 2	1 4 N	4 2	2 3	1 2	1 1	1 1	1 2	2 1			1 3	1 2	1 2	2 2	1 2	1 1
7 FLUID FLOW	2 1 3 2		2	3	3 1 3 2			3 3	3 3 2	3 3	3 3	2 1 2	2	2 2	2 1 2		2 2			2 1 2	2 1 3			2 1 1
8 PRESSURE	3 2 1	3 2 1 1	3 2 2	3 4 4	4 3		1 .	3 1 2	3 2	3 3	4 3 2 1		2 1 1	1	1	2 1 2 1	2 1 3 1	1	2 2	3 4 1	4 1 4 1	4 4 1	1	1	3 1 1
9 TEMPERATURE	3 3 4 3	2 3 2	2 1 3 2	3 3 2	2 3 2		2 1 2	2 3 2	2 3 2	3 2 3	3 3		2 1 2 2	2 1 2 2		2 1 2 2	2 1 3 2	2 1 3 2	2 1 3 2	2 1 3 2	2 1 3 2	2 1 2 2	1	3	1 1 1
10 HUMIDITY & MOISTURE	2 1 2		2	3 3 1 3	2 1 2		3 3 2	3 1 3		3 1 3	2 2	1	3 3 2			3 3 2	2 2 1		2 1 2	2 1 2	3 1 2		1	1 1
11 THERMODYNAMIC PROPERTIES OF FLUIDS	4 2 3 1	4 1 3 2	4 2 3	3 1 3 2	4 1 3 1			3 1 2 2	2 2 3	3 1 1 4 2	3 1 4 2	2 2 3	2 2 1	2 3 1 2		X	2 3 3 3	1 1 2	2 1 1 2	2 1 2	2 2 2		2 2		
12 CRYOGENICS	4 1 4 4	4 1 2 2	4 1 3 2	3 1 3 2	4 1 4 2	3 2 1	3 1 2 2	2 2 2	2 1 2	3 2 4 2	2 1 4 2	2 2	2 1 3 4				2 1 3 2			2 1 3 2	2 1 3 2	2 1 3 2	1		1 2 1 2
13 ELECTRICITY	3 2 3 3	3 1 3 2	2 1 4 3	1 4 4 3	4 1 4 3		1	3 2 4 3	3 1 3 2	2 2 2	3 1 3 2	1 2 2	1 1 2 2				3 1 1 2	3 1 2	1 3 3 2	1 3 3 2	3 1 4 1		2 1 2		
14 ELECTROMAGNETICS	3 2 4 2	3 3 1	2 2 2 1	3 2 4 1	3 1 4 1			3 2 4 1	3 2 2 1	1 3 1	1 3 3 1	2 2 1					2 2 1		1	3 2 3 1	3 2 3 3	4 3 3	1		
15 MEDICAL ULTRASONICS	3 2 2 3	2 2 4	2 2 2	2 3 2 3	2 1 1			3 1 2			1		2 1 2 1									3 2 1 2			
16 ACOUSTICS	2 2 3 N		2 1 2 3 1 4	1 3 1	2 1 3 2			2 1 1	3 3 4 2	2 1 2	2 3	2	3 2 3 1			2		1		2 1 3 2			2 3 1 2	2	
17 RADIOMETRY & PHOTOMETRY	3 1 4 2	3 1 3 2	2 3 1 3 2	4 1 3 2	4 1 3 2			4 1 4 2	4 2 2 2	2 1 3 1 2 N 2	2 3 2		2 1 4 2		1					3 1 4 2					3 1 2
18 SPECTROPHOTOMETRY		2	x	1 3 1 3 2 2	1 1 2			2 2 2 2	2 1 2 2	1 1 1	2 3 1 2	1 1 2	2 2 4			2 3 2 3 2 2				2 3 2 3 2 2	2 3 2 3 2 2	2 1 2 2	2 1 2 2		
19 FAR ULTRAVIOLET RADIOMETRY	2 2 3 1	2 3 3 2	?	2 2 2	4 2 2			2 2 2 3 2	2 3 2	2 2 2 1	3 2 3					2 2 2 1 1 2	2 2 1 4					2 3 1 4	2 2 1 4		
20 OPTICS	2 1 2		2 2 3 1	3 1 2	3 1 2	1 1 N		4 3	3 1 1	4 3	4 1 2	1			2 1 2		1	4 4	4	4 2		2 1 3	2 1 1	1		
21 LASERS	4 3	4 2	4 3	4 4 2 4	4			2	4 4	4 4	4 4	1 3 1	1							4 2 4 4 3 2		3	3		
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	3 4 3			2 2 2	3 4 4					3 4 2	3 4 2						3 3 3			3 4 2					
23 SURFACE PROPERTIES	4 1 3 2		3 1 2 2	3 2 2	3 2 3 2			2 2 1 2		3 2 3 2	3 2 2						2 3 2 3	1 2 3 2		3 2 3 2	3 2 3 2				
24 IONIZING RADIATION	2 1 3 2	3 2 4 2	3 3 1 3	3 1 4 3	4			3 3 4 2	3 3 4 2	3 2 4 3 4 2	4 3 3 4	2 2 3				2 2 1 2	2 2 4 3			2 2 3	4 3 4 3	4 4 3 4	4 3 2		1
25 AVERAGE	3 1 3 1	3 1 3 2	3 1 3 2	3 1 3 2	3 1 4 1	3 1 1	4 1 2 2	3 1 3 1	3 1 2 1	3 3	3 1 3 2	2 1 2 1	2 1 2 2	4 1 2 1	2 1	2 2 2 4 2 1 2 2		2 1 1	2 1 2 1	4 3 4 2	2 1 3 1 4 1 2 1	4 2 4 2	4 3 4 2	2 1 1

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0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 6. Other U.S. National Standards Authorities

Only three such organizations have been identified: The U.S. Naval Observatory (USNO) in the field of time-keeping (time and frequency). The U.S. Geological Survey in aerial camera calibration (optics). The U.S. Coast Guard for measurements related to sea transportation of liquified natural gas. Note that only the specified aspects of these agencies' operations are covered in this sector. All other aspects are covered in sectors 10 and 11.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO OTHER U.S. NAT'L STANDARDS AUTHORITIES — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	3											3 1 1 2								1					1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 1 3											3 1 1 2													1
3 OOCUMENTARY STANOARDIZATION ORGANIZATIONS												3 1 1 2								2					
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 1 2											3 1 1 2													1
5 NBS	3 1 3											3 2 1 2								1 1 N					3 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	3 2											3 2 2 2								2					3 1 1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES	1 R																								
8 STANOARDS & TESTING LABORATORIES AND SERVICES	1 R																								
9 REGULATORY AGENCIES (excl. OWM's)	1 R											2 2 2													
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	3 R											3 1 2													1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1 R											2 2 1 2								2 R					1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)												1 1 2								2 R					1
13 INDUSTRIAL TRADE ASSOCIATIONS												2 2 1 2													
14 AGRICULTURE, FORESTRY, FISHING: MINING (SIC Div. A & B)	1 R																								
15 CONSTRUCTION (SIC Div. C)																				2 R					
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)																									
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)																									
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)																									
20 ELECTRIC AND ELECTRONIC EQUPMT (SIC Major Gp 36)	1																								
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)												2 1 2													
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3 1 3 2											2 1 2								2 R					3 1 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)																									
24 HEALTH SERVICES (SIC Major Gp 80)																									
25 GENERAL PUBLIC	1 R																								

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF OTHER U.S. NAT'L STANDARDS AUTHORITIES / MEASUREMENT SECTOR	USERS	KNOWLEDGE COMMUNITY (Science, Education Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl OWM's) 9	DEPARTMENT OF DEFENSE (excl Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY		2	3		2	3	3		2	2	4 ? ?	2			4							4				1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS																										
3 VIBRATION & SHOCK																										
4 SURFACE FINISH																										
5 MASS, VOLUME & DENSITY																										
6 FORCE																										
7 FLUID FLOW																										
8 PRESSURE																										
9 TEMPERATURE																										
10 HUMIDITY & MOISTURE																										
11 THERMODYNAMIC PROPERTIES OF FLUIDS																										
12 CRYOGENICS		3 1 2	1 3 1 2	1 3 1 2	1 3 1 2	3 1 2	3 2 2			2 2 2		2 2 2	1 1 2	2 1 2							2 1 2	2 1 2				
13 ELECTRICITY																										
14 ELECTROMAGNETICS																										
15 MEDICAL ULTRASONICS																										
16 ACOUSTICS																										
17 RADIOMETRY & PHOTOMETRY																										
18 SPECTROPHOTOMETRY																										
19 FAR ULTRAVIOLET RADIOMETRY																										
20 OPTICS		1		1	1	2 1	2					2	2			2							2	1		
21 LASERS																										
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																										
23 SURFACE PROPERTIES																										
24 IONIZING RADIATION																										
25 AVERAGE		1				2 1	3 1 1		1	1	2	1	1	1	1	1							1	1		

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, λ = Not studied, Blank = 0

Sector 7. State and Local Offices of Weights and Measures (OWM's).

The state, county, and city or similar agencies responsible for policing the honesty of weights and measures practices in commercial transactions. Note that these agencies are almost always a part of the state and local governmental structure, but are explicitly accounted for only here and not as part of sector 12. Similarly, they are clearly a type of regulatory agency, but are not included in sector 9.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO STATE & LOCAL OFFICES OF WTS & MEASURES — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)								1 1		2 2		3 1 2													1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS					2 4 1 4																				
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		3 1 1			3 1 2	1		1 1 1		2 2 2		3 1 3 2													3 1 1 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	1	1 1 2			2 1 2			1	1	3 2 2		3 1 2	3 1 1 2												1
5 NBS	3 1 2 2	3 1 1 N			4 1 4 2	1 1		1	2 1 1 2	3 3 2 2		3 1 2 2	1												4 1 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) *	2	2 1 2			4 3	2			1	2		4 1 2 2	1												4 2
8 STANDARDS & TESTING LABORATORIES AND SERVICES		2 2 1										2 1 1													
9 REGULATORY AGENCIES (excl. OWM's)	1 R					1 R						3 1 1 2 R													
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)					1 R																				
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)										2															
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	2 R	2 R			2 R	2 R				1 R		1 1 2 R													1 R
13 INDUSTRIAL TRADE ASSOCIATIONS						1 R				1		2 1 2 3													1
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)					2 R					3 R															1 R
15 CONSTRUCTION (SIC Div. C)					1 R																				1 R
16 FOOD/TOB/TEXTILE APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)					4 R																				2 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)												2 1 1 2													1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)					1																				1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)					2	2 2			2 1 1 R																1
20 ELECTRICAL AND ELECTRONIC EQPMT (SIC Major Gp 37)																									
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)												2 1 1 2													
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2	1 R			3 R				2 1 1 R			2 1 1 2													1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1 R	2 1 2 R			4 R	3 R			2 1 1 R			1													2 R
24 HEALTH SERVICES (SIC Major Gp 80)									1 R																
25 GENERAL PUBLIC	1 R	1 1 1 R			3 1 3 1 R																				1 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF STATE & LOCAL OFFICES OF WTS & MEASURES — USERS / MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	U.S. NATIONAL STANDARDS LABORATORIES 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Req. Aq.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Req. Aq.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, Bal I, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY				1 R	3 1 1 2 R	1 R	2		1			1										2	1		1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS			2 1 1	1 1 2 R	2 1 1 R		2 1 2	2 2 2				1											3 2 3		3 1 1
3 VIBRATION & SHOCK																									
4 SURFACE FINISH																									
5 MASS, VOLUME & DENSITY		2 2 1 1	2 1 1	3 1 2 R	4 1 4 R		4 3	2 1 2	1	1		3 1 3 1		2	1	3 1 4 2	1		3 1 3 2 R		1	3	4 4 1		4 1 3 1
6 FORCE		1	1		1 R		2	4 2	2 1	1		3 2	2 2	2 3	2 1	1 1	1 1		3 3		1 1	1 2	3 4		1 2
7 FLUID FLOW																									
8 PRESSURE					1 1 R																				
9 TEMPERATURE					1 1 1 2 R		1		?			1 1 2		1 2 1 2		1 2 1 2	1 2 1 2	1 2 1 2	1 2 1 2	1 2 1 2	1 2 1 2	1 2 1 2	1 2 1 2	1	1 2 1 2
10 HUMIDITY & MOISTURE			2 2 1 2	2 2 2 R	2 3 2 R		2				1	1	1	2		?							?		
11 THERMODYNAMIC PROPERTIES OF FLUIDS																									
12 CRYOGENICS	3 1 2		3 1 3 2	3 1 2 2 R	3 1 2 2 R		4 1 2 2	2 1 1	3 1 1 2			1 1 2	2 1 3 2					2 1 1			2 1 2	2 1 1 2	2 1 1 2		
13 ELECTRICITY				2 1 1 2 R			1																		
14 ELECTROMAGNETICS																									
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS																									
17 RADIOMETRY & PHOTOMETRY																									
18 SPECTROPHOTOMETRY																									
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20 OPTICS																									
21 LASERS																									
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION																									
25 AVERAGE		1	1	3 1 1	4 1 2 1 R		4 2	1	1			3 1 1	1	1		3 2 1 2	1		3 1 1 2		1	2	4 3 1		4 1 1

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USERS: C D A B R

? = Unknown, X = Not studied, Blank = 0

Sector 8. Standards and Testing Laboratories and Services.

Members of the National Conference of Standards Laboratories and organizations eligible for such membership (except for the weights and measures laboratories of sector 7). Testing laboratories such as Underwriters' Laboratories and the many commercial analytical laboratories. Standards services such as the airport clock synchronization services.

Note that NBS is covered explicitly in sector 5, not here. Also, note that standards services provided as a coincidental adjunct of another major business, such as telephone time-of-day services provided by the telephone company and the standard 60-cycle frequency signal of the electric power companies, are handled as measurement services provided by that business sector.

Note also that all standards laboratories and organizationally distinct testing laboratories are included in this sector, no matter in what larger organization they may be embedded. Thus, the standards laboratory structure of the Department of Defense is covered here, and the standards laboratories of the major economic industrial sectors. The measurements transactions of those sectors thus include as inputs the contributions of their own in-house standards and testing laboratories, and do not include in their outputs the outputs from such laboratories.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO STDS & TESTING LABORATORIES & SERVICES — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY, (Science, Education, Prof. Soc. & Publ.)	2	1 1	2 1	2 2	1	1	2 2	1 2		1	2 1 3	2 1	3 1 2 2	3 1 2 2		2	3 3 2 2	2 1 2	2 1 2	2			2 2 1 2	3	2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	1																	1 2 1 2							
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		3 1 3	2 2 1	3 2 3	4 3	3 3	2 1 2 2	2 1 2		3	2 1	2 1 2	2 1 2 2	2 2 3 1		2 1 3	3 2 1 2	1 3 2	?	3			2 2 1 1	3	3 1 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 1 3 2	2 1 2	2 1 2	2 1 2	2 3 2	1 2	4 1 3	2 3	2 1 3 2	3	2 1	2 3	3 1 4 2	3 2 4 2		3 2 3 2	4 1 2 2	2 1 2 2	2 1 2	3	1		3 1 1 2	3	3 1 3 2
5 NBS	3 1 3	3 1 4	2 1 2	3 1 2	2	3 3	3 3	3 1 2	2 3 3 2	3	3 1 2 2	2 2 2	3 2 4 2	3 2 4 1		2 1 2 1	4 1 4	2 2 2 2	2 4 2	3	2		2 2 1 2	3 3 3	3 1 3 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2																								1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)		2 2 2			2 1 2	4 2						2 1 1													1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	4	2 2 2	2 2 2	3 1 2	2 2	2 3	2 1 3	2	3 2 2	2		1 2	3 1 4 2	3 1 4 1		1 2	3 1 3	2 2 2	2 1 1	2	2		2 2 1 2	2	3 1 3 1
9 REGULATORY AGENCIES (excl. OWM's)			1 R	I R	3 2 2 R	R	2 1 R	R				2 1	3 1 3 3 R	2 2 3 R		3 1 3 2 R	2 1 2 R	2 2 2 R	2 3 2	1 R	1			3	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	4 R	3 R	2 R	3 1 2 R	3 R	2 4 R	3 R	1 R	2 1 3 2 R	3 R		2 1 R	3 1 3 2 R	3 2 4 2 R		X	4 1 3 R			1 R			2 2 1 2 R	2 R	3 1 3 1 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3 R	1 R	3 2 3 R		3 R	2 3 R	2 R	2 1	1 R	1		2 2	3 1 2 2 R	2 2 4 2 R		2 R	2 1 2	2 3 4 R		1 R			2 2 1 2	2 R	2 2 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)					1 R	3 3 R	2 R			1 R		2 2 R	3 1 2 2 R			2 R				1 R					1 R
13 INDUSTRIAL TRADE ASSOCIATIONS		1		2 1 2 R	2 1 2 R	3 3 R			?			2 2	3 1 2 2 R	1 1 2 1 R		3 1 3 2 R	2 1 2	2 1 2							3 1 1
14 AGRICULTURE,FORESTRY FISHING, MINING (SIC Div. A & B)	1 R				1 R	2 2 R	1 R									1 R									1 R
15 CONSTRUCTION (SIC Div. C)					1 R	2 2 R	1 R									3 R				1 R					1 R
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				?	2 1 R	2 3 R			2 1 R							2 R		2 1 2 2 R							2 1 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					2 R	2 3 R	1 R	1 R	2 1 1 R			2 1	2 1 2 R			2 R		2 1 2 R				2 2 1 2	2 R	2 1 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)				1 R	1 R	2 3 R			2 1 R				2 2 2 R			2 R			4 3 R			2 1 2	2 R	3 1 R
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 1 R	1 R	1 R	2	2 3 R			2 1 1 R				2 1 1 2 R			2 R			4 1 R					2 1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1	2 1 2 R	1 R	4 2 R	1 R	2 2 R			2 1 1 R				3 1 4 2	2 2 4 3 R		2 R	4 1 3 2	2 1 2 R		2	1		2 2 1 2		3 1 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1 R	2 1 3 R	2 2 R	2 R	1 R	2 3 R	2 1 3 R	1 R	2 1 1 R			2 2	3 1 3 2 R	2 2 4 3 R				2 1 1 2 R		4 3 R			2 2 1 2		2 1 2 1 R
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 1 3		1 R			2 1 R	2 1 3 R	1 R	2 1 1 R			2 1	2 1 3 2 R	3 2 4 2 R		2 R				2 R				2 R	2 1 2 1 R
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1 R					2 1 R			2 1 1 R									2 1 1 2 R		1 R				2 R	1 R
24 HEALTH SERVICES (SIC Major Gp 80)													3 3 1 2 R			2 R								3 R	1 R
25 GENERAL PUBLIC								1 R								1 R									

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF STDS & TESTING LABORATORIES & SERVICES

USERS

MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOVT AGENCIES (exc. OWM's & Regl. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY	1			2 ? 3 ? R	2 1 2 R	1 R		4	1	3 ? 4 3	3						1	1	1	3	3	2 1 3 2	1	
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 4 1		2 1 2 1 2 R	2 1 2 R	3 2 2 R		2 2 1	2 2 2		3	2	1			1		1	2 1 1	2 1 2	2 1 2	2 1 3		1	
3 VIBRATION & SHOCK	2 2 1		2 2 2 2 1 2 R	2 2 2 R	2 2 N R			2 2 2	1	2 3	2 1 2							1	1	2 1 2 1	2 2 1			
4 SURFACE FINISH	1 1 1		3 1 3 2 R	4 3 2 R				3 1 2		3 3	2 1 2		3 1 3			1	1	2 1 2	2 1 2	3 1 3	3 1 3		1	
5 MASS, VOLUME & DENSITY			1 1 1 2 R	2 2 R				2 2		3	1 3	1		1			1	2	1 R	1	1	2 2 1		
6 FORCE	2 2		2 3 2 2 R	1 2 R				2 3	2 3 2	3 4	3 4	2 2	1 2	3 3	3 3	2 3	2 3	2 4	2 3	2 3	2 4	2 2	3 2		
7 FLUID FLOW	1		2	2 1 2 3 2 R	1 2 3 R			2 1 3	2	3	2	2	1	2 1 3 2	2		2 1 2	1	1	2	2 1 3 2	2 1 3	1		
8 PRESSURE	2 1		2 2 2	2 1 3 R	1 R			2		2 3	2	1		1	1	1	2 1	1	1	2	1	2 2	2 1	?	
9 TEMPERATURE			2 2 2 3 R	2 2 R				3 2 2		3 2 3 2 3	2			1		1	1	1	1	2	1	1	1	1	
10 HUMIDITY & MOISTURE	1		2 2 2 1 R	2 2 1 R				2		2	2	1					1	1	1	1	1		1		
11 THERMODYNAMIC PROPERTIES OF FLUIDS																									
12 CRYOGENICS	2 1 1		2 1 2 2 3 R	2 2 R			2 1 1	1 2	2 1	2 1	2 2	2	2 2				2 1			2	2 1	2 1			
13 ELECTRICITY	3 1 2 2		2 1 3 1 3 4 2 2 R	2 2 3 2 R				3 1 4 2 3	3 1 2	3 2 3 4 2 3 2	3 1 2 2	1 2					3 1 3 2 2	3 1 3 1 3 2 2	3 1 3 4 2	3 1 3 2	3 1 4 2	1	3 1 2 3		
14 ELECTROMAGNETICS	2 2 2		3 2 3 2 3 4 2 2 R	3 1 4 2 R				3 1 4 1	3 2 2	4 2 3 4 2 1	3 1	2 1 2 1					1	1	1	3 4 1	2 4 1	3 2 3 1	1		
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS	1		3 3 2 R	2 1 2 P				1 2	2 1 2 4	x	2		3 4 2	2	3	3	3	3	2	2	3	2	1	1	
17 RADIOMETRY & PHOTOMETRY	2 1 2 2		2 2 2 3 2 2 R	3 1 2				3 1 3	2 1 3 2	4 2 2 3 2 N 2	2	2 1 2									2 2 2	1	1		
18 SPECTROPHOTOMETRY	2 1 1 2		2 2 2 1 1 2 2 R	2 1 2				2 2 2 2 2	2 1 2 2	2 1 2 2 2 2	2 1 2 2	2 1 2	2 1 2			2 1 2 2	2 1 2 3			2 1 2 2	2 1 2 2	2 1 2 1 2 2	2 1 2 4 2	1
19 FAR ULTRAVIOLET RADIOMETRY	2 2 1		? 1 2 P	2 2				2 1 2	2 2 2	2 2 2 1 2	2 2					2 2 1 2	2 1 2 4			1			2 2 1 3		
20 OPTICS	1		2 1 P	2 2 1 R				2		2	1	1			2		1	4 3	4 2		4 3	2	1	3	
21 LASERS			1 R					2	1	2	1									1	1	1			
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES	2 2 1 2		2 2 2 1 1 2 2	2 2				2 2 1 2		2 2 1 2 2 2 1 2	2 2	2					2 2 2 2	2 2 2 2		2 2 2 2	2 2 2 2				
24 IONIZING RADIATION	2		1 2 3 2 P	1				2	3 3 2	2 3				1		1	3	3 3 3 2		1	2	3 3 4 2	4 4 3 2		
25 AVERAGE	2 1 1 1		2 2 1 2 3 1 P	3 1 2 P				3 1 3	2 2 1 2	3 1 3 3 1	3 2 1	1	3 2 1	1	1	1	2 2 1 3	1 3 1	3 1 3 2 1	3 2 1	3 1 3 1	3 2 3 1 1	3 2 2 1 2		

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

R = Flow of requirements info dominates

? = Unknown, x = Not studied, Blank = 0

Sector 9. Regulatory Agencies (excluding Offices of Weights and Measures).

Federal, state, and local government regulatory agencies, excluding those units which regulate the commercial weights and measures field or which perform classical policing or law-enforcement duties, or the normal legislative branches of government. Examples at the Federal level include the Bureau of Mines, Consumer Product Safety Commission, Environmental Protection Administration, Federal Communications Commission, Federal Power Commission, Food and Drug Administration, Interstate Commerce Commission, National Highway Traffic Safety Administration, and the Occupational Safety and Health Administration. On the local level, similar agencies are active primarily in the public health field, in occupational safety and health, in the regulation of radiation sources generally, and in enforcing environmental protection regulations. While the presumption is that all of these agencies are governmental, there may be instances of private or quasi-governmental agencies that fall in this sector.

Note that these regulatory agencies are covered only here and not also in sectors 11 or 12. Where a given administrative agency has both regulatory and operational responsibilities, such as the Coast Guard or the FAA, it has been included in only that sector that seems to include the major portion of its responsibilities, sector 11 in these cases.

The regulatory agencies are both major suppliers and major users of measurements information. Technological regulation without measurement is impossible.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO REGULATORY AGENCIES (excl. OWM's) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.	1		2		2 2 1 2	1	2 1 3 2	3 1			3 1 2 4	3 1 2	1	3 1 3 2	1	2	3 3 2	2 2 1	2 3 2	2	4 3			3	3 1 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	2																	1 2 1							1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS			1		1	3 3	3 2 2	3 2			3 2 1	3 1 4 2	2 1 2	3 2 3	2	2 2	2 1 2	2 3 2	2 3 2	3	1			4	3 2 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2		2		2 2 2	2 2	4 2 3 2	3 3	2 1 2		2 1 2	3 1 2 2	3 3 2	3 2 3 2	1	2	4 1 3 2	2 3 1 2	3 2 1 2	2	3			3	3 1 2
5 NBS	3 3		1		3 1 3	3 3 2	3 3 2	3 2	2 3 2		2 2 3	2 1 2	3 1 3	3 2 1	3 1 2	3 4 1	4 2 2	2 2 2	2 3 2	3 1	4 4			3 3 3	3 2 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2											2 2													1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	1				1	2 1			?			3 1 2													1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1		1			2 3 2	2					2 1	3 1 2 3	3 2 2		2 4 1	2 1 3 2	2 1 2 2	2 2 2		1			3 2 3 2	2 1 2 2
9 REGULATORY AGENCIES (excl. OWM's)	3		2		3	2	3	2 2	1 4 1 ?			2 1 2 2	1 1 3	3 2 3 2	2	3 3 4 1	3 1 3 2	2 2 2	2 3 2	2	4 3			4	3 2 3 1
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	1		1			1	2	?				1 1 2	1	2 2 1		X	1 1							2	1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1		1			2 4 2	2	?				1 1 2 2	2 1 2	2 2 3 1		1	2 1 3 2		2 3 2	1	2			4	2 1 2 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	1					1	3					1 1 2	1			1		2 1 2			1				1
13 INDUSTRIAL TRADE ASSOCIATION					2 2 3 1	2 ? 3 2	3					2 1 2		2 2 3 2		2 4 2	2 1 1 2	2 2 1 2			4 3				2 1 2 2
14 AGRICULTURE,FORESTRY, FISHING: MINING (SIC Div. A & B)	2					2 1	2		2 1 1							2								3	1
15 CONSTRUCTION (SIC Div. C)						2 1	1									3				1	1				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26,31)					2 1	2 1			2 1 1							3 1 3 2		2 2 2	2 3 1 2		1			1	3 1 2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					1	2 1 1	1		2 1 1			2 1 2				3			2 3 2 2	2	2			4	2 2 2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)					1	2 2			2 1 1							3				3	1			4	2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)			1		1	2 2	1		2 1 1							2 1 4 2				1					1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1		1			2 1			2 1 1					2 2 2 2		1	4 1 2		3 3 1 2	1	2			2	3 1 1 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1		2		2 2 2 2	2 2 2 2	2 1 3 2	2 2	2 1 1			2 1 2 2		2		3 1 3 2	1			2				2	2 1 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2 ? 3 ?				2	2 2 2	3 2 4 2	2 2	2 1 1			2 1 2 2	3 1 3 2	3 2 4 2		3 1 3 2				2	1			4	3 2 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)					1	2 2			2 1 1												2			4	2
24 HEALTH SERVICES (SIC Major Gp 80)					3 1 2 1			?	1					1	2	2	1 R	1	2 1 3 2	2	1			3	1
25 GENERAL PUBLIC					3 1 2 1 R		2 R		2 1 2 R			2 1 2 R	2 R			1 3 2 R	2 1 2 R		3 R	1 R	1 R			3 R	2 1 2 R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF REGULATORY AGENCIES (excl. OWM's)		KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 5	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 6	STANDARDS & TESTING LABORATORIES AND SERVICES 7	REGULATORY AGENCIES (excl OWM's) 8	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 9	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 10	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 11	INDUSTRIAL TRADE ASSOCIATIONS 12	AGRICULTURE, FORESTRY, FISHING, MINING (SIC Div. A & B) 13	CONSTRUCTION (SIC Div. C) 14	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 15	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 16	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 17	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 18	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 19	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 20	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 21	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27) 22	HEALTH SERVICES (SIC Major Gp 80) 23	GENERAL PUBLIC 24	
MEASUREMENT SECTOR																										
1 TIME & FREQUENCY					2 R	3 2 R	1 R	1 R	3	2 R	3 R			2 R						2 R	1 R	3 4 R	? 1 R		1 R	
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS				1																						
3 VIBRATION & SHOCK		1		2	1 R	2 2 1 2 R			1 R	2										1 R	1 R	2 R				1 R
4 SURFACE FINISH																										
5 MASS, VOLUME & DENSITY				1	1 R				1 R	3			1 R			3 1 3 1 3 2 1 R				1 R	3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	1 R
6 FORCE	1		3 2 2 4 2 7	2 R	2 R	2 2 R	1 3 2 R		2	2 R	3 R	2 R	3 2 R		3 1 R	3 1 R	3 1 R	3 1 R	2 R	2 3 R	2 2 R	3 4 R	3 4 R	3 4 2 R		3 4 2 R
7 FLUID FLOW	1		1	2 R	3 1 3 R		2 R		3	1 R	2 3 R	3 1 2 R	1 R		3 1 2 R	3 1 2 R	3 1 2 R	1 R		1 R	1 3 R	3 1 2 R	3 1 4 R		1 R
8 PRESSURE				3 3 R			2 1 R		2 2 R		1 R									3 2 R	3 3 R	3 R				
9 TEMPERATURE					2 4 1 2 R				1 4 1 ?		?			3 1 2 R		3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	3 1 2 R	4 3 1 2 R
10 HUMIDITY & MOISTURE																										
11 THERMODYNAMIC PROPERTIES OF FLUIDS																										
12 CRYOGENICS	3 1 2 2		3 1 3 1 4 2 2		2 1 2 2 R	2 1 2 2 R	3 1 2 1 2 R		2 1 2 2 R	1 1 1 1 2 2 R	2 1 2 2 R	2 1 2 2 R	2 1 3 2 R				2 1 2 2 R					2 1 2 2 R	2 1 2 2 R			2 2 1 2 R
13 ELECTRICITY	2 1 3		2 1 3 1 2 3 3 R		2 2 2 3 R		3 1 3 R		1 1 3 R	3 1 3 1 2 1 3 R	3 1 3 R	3 1 3 R	2 1 2 R		1 1 R	1 1 R	3 1 1 2 R	3 1 1 3 R	3 1 1 3 R	3 1 1 3 R	3 1 1 3 R	3 1 1 3 R	3 1 3 R	3 2 3 R		3 R
14 ELECTROMAGNETICS	3 2 2		3 2 2 3 3 3 R	2 2	3 2 1 R		2 2 3 2 R		3 2	2 1 3 2 1 R 1 R	2 3 R	3 2 R	2 2 1 R				1 1 R	3 2 2 R	3 2 2 R	3 2 R	1 4 2 R	3 2 R	3 2 R		1 1 R	1 1 R
15 MEDICAL ULTRASONICS		2	2 2 R		3 1 2 R				2	?														4 ? 3 2 R		
16 ACOUSTICS	1		1 2 R		3 3 1 R		3 1 2 R		3 4 1	X 2 1 R		3 1 4 R	1 R		4 2 4 4 3 4 R 2 R	1 4 2 R 4 R	2 2 R	4 1 2 R	4 1 2 2 4 R	4 1 2 R	4 1 2 R	4 1 2 4 R	4 1 3 R	4 3 4 R	3 2 4 R	3 2 R
17 RADIOMETRY & PHOTOMETRY	3 1 3 2		2 1 3 2 R		3 1 2 R		2 1 2 R		3 1 3	2 1 2 R	2 1 2	2 1 2				1 1 R R					3 1 2 R	1 R		2 R	4 3 2 R
18 SPECTROPHOTOMETRY	1 1 2		1 1 2 2 2 R		2 1 2 R		2 2 2 R		2 2 2	2 3 1 2 R	2 3 R	2 3 R			3 2 1 2 R R	1 R			1 1 R	2 3 2 4 R	3 2 2 R R	2 1 2 R			
19 FAR ULTRAVIOLET RADIOMETRY	3 2 2 2		2 2 3 2 2 2		2 2 2		2 3 2		2 3 2	2 2 1 2					3 2 3 1 1 2 R	2						3 1 2		2 2 2 2
20 OPTICS	1		1 2 P				1 P		2	3 1 R R					2 R	3 R	1 4 R P	1 1 R	1 1 3 R		3 R	2 R		1 R
21 LASERS	1		1 2 4 4		2		1		4 3	2 3 2 R R			2		1 R	1 R	4 2 R R	4 2 R	4 2 R	1 4 2 R	2 R	3 2 R	4 2 R	1 R		1 R
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																										
23 SURFACE PROPERTIES																										
24 IONIZING RADIATION			4 3		4 3 4 P		3 P		4	3 R 4 R	3 R				3 R	2 R	4 R		3 R	2	4 4 2 3 P	4 R	3 P	2 P	
25 AVERAGE	3 1 1 2		3 1 3 1 2 2 3 2		3 2 2 P		3 1 2 P		3 2 1	2 1 3 1 1 R 2 R	1 2 1 R	2 1 2 1 P	2 1 2 R		1 2 1 R 1 R	2 1 2 1 R 2 R	2 1 2 2 1 P	1 2 1 R 1 R	2 3 1 3 1 R 1 R	1 2 1 R 1 R	2 3 1 R 2 R	2 1 2 2 P	1 2 2 3 P	2 2 P	3 1 2 P	

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
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B - RATE OF CHANGE

\ = Declining
0 = Stable
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4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
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A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 10. Department of Defense (excluding standards laboratories).

The Air Force, Army, Navy, Advanced Research Projects Agency, Defense Nuclear Agency, Defense Supply Agency, and all intelligence and security agencies. Note that the standards laboratories and closely related organizations which are formally part of the DOD are excluded from this sector and accounted for in sector 8. Similarly, the formal documentary standards organizations in the DOD are included in sector 3. Inversely, note that the civilian intelligence agencies are included here, as a matter of practical convenience.

Ever since World War I, the technological demands of the defense establishment have placed high demands upon the measurement system. The atomic bomb, radar, modern solid-state electronics, computers, lasers, and satellite reconnaissance and intelligence are just some of the developments during the past several decades in which the military has had a vital interest and which have posed substantial measurement problems. Maintenance alone of the military inventory of high technology equipment involves a major measurement effort.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO OEPT. OF OEFENSE (excl. Stds Labs) — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY 1	LENGTH & RELATED DIMENSIONAL MEASUREMENTS 2	VIBRATION & SHOCK 3	SURFACE FINISH 4	MASS, VOLUME & DENSITY 5	FORCE 6	FLUID FLOW 7	PRESSURE 8	TEMPERATURE 9	HUMIDITY & MOISTURE 10	THERMODYNAMIC PROPERTIES OF FLUIDS 11	CRYOGENICS 12	ELECTRICITY 13	ELECTROMAGNETICS 14	MEDICAL ULTRASONICS 15	ACOUSTICS 16	RADIOMETRY & PHOTOMETRY 17	SPECTROPHOTOMETRY 18	FAR ULTRAVIOLET RADIOMETRY 19	OPTICS 20	LASERS 21	PHYSICAL PROPERTIES OF ATOMS & MOLECULES 22	SURFACE PROPERTIES 23	IONIZING RADIATION 24	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.	3	3	2 1	2 2 3	2 2 3 N	2	2	3 1 2	1 3	2 1	3 1 3 3	2 1 3 2	3	3 1 4 2		4	2 3 2	2 ? 2	2 3 2 2	3	4 4	3 3 4 1	3 2 3	3	3 1 3 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	2			1																					1
3 OOCUMENTARY STANOARDIZATION ORGANIZATIONS		2	2 3	3 2 3	1 1 1 1	2 3	2	1	1	3	3 1 2 1	3 1 2	2 1 2 2	4 2 3 1		X	2 1 2	2 ? 2 2	?	2	1		2 2 1 1	2	3 1 2 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 2 4 2	4	2 2	2 1 2	2 2 2	1 2	2	2 4	4 1 4 2	4	2 1 1	2 3	3 1 4 2	3 1 4 2		3 1 4 3	4 1 3	2 ? 2 2	2 2 2	4	4	3 2 3	3 1 3 3	4	3 1 S 2
S NBS	3 ? 4	1	3 1 1 N	3 2	1 2 N	1 4 N	3 3	3 3	2 3 3	3 1 3	3 1 4 1	3 4 2	2 2 2	2 1 3		2 1 2	2 1 2 N	1 1 1	2 2 1	4 3	4 4	3 4 2	3 2 3 2	3 2 3 0	3 3
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	4 ? 4 ?																								2
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					1	1																			
8 STANDARDS & TESTING LABORATORIES AND SERVICES	3 ? 4 ?	3	2 3	3 3	3	3 4	3	2 3	3 2 3	2		2 1	3 4 2	4 2 4 2		X	4 2 3 N	2 1 2 2	2 2 1	2	2		2 2 1 2	2	3 1 3 1
9 REGULATORY AGENCIES (excl. OWM's)	2 R					3 2 R	1 R					1 1 2 R	3 1 3 R	2 1 1 R		X					2 R			3 R	2 1 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	4	4	2	3 3	1 3	3 4	4	4 1 4	4	4	3 2 3 1	2 1 3 2	3 ? 4 2	2 2 4 1		4	4 1 4	2 ? 4 3	2	4	4	2 3 2	4 2 3 3	4	3 1 7 1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1	1	2 2 2	2 2		2 2	2	1		2	2 1 2 3	2 1 2 2	1	3 2 2		X	1 1 1		4 2 1 2		3 2 2	2 2 2 2	2 2 2 3	2	2 1 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1					2									X								1 R	1
13 INDUSTRIAL TRADE ASSOCIATIONS		1		3 2 R							2 1 3	2 1 2		2 2 2		X	1 1 1				1				2 1 1
14 AGRICULTURE, FORESTRY, FISHING: MINING (SIC Div. A & B)						1 ? 1 ?	1									X								1	1
15 CONSTRUCTION (SIC Div. C)		1			1	1 ? 1 ?	2									2					1				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				?	1	2 3			2 1 1	1						X		2 2 1 2						1	1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-3D, 32)					2	2 2			2 1 1	1	1 1 1 2	1 2	3 1 2			X		2 2 2 2	2 1 2	1	1		2 2 2	3	2 1 1
18 PRIMARY & FAB. METAL PROOUCTS (SIC 33-34, 391)		1	1	3 3	2	2 1							3 1 2 2			X				3	1		2 2 2	4	3 1 2 1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		3	2 2 2	3 3	2	2 3	1		2 1 1	1			3 1 3 2	1		X				1					3 1 1
20 ELECTRIC AND ELECTRONIC EQUPMT (SIC Major Gp 36)		1	2	4 3 2		2 1			2 1 1	2 1			3 1 4 2	3 2 4 2		4	4 1 2	2 2 2 2	2 1 2	3	3	3 4	2 2 2 2	2	3 1 3 1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		3	2 3	1	1	2 2	3	3 2	2 1 2	2		1 1	2 1 3 2	3 2 4 2		2		2 2 1 2		4			2 2 2	3	2 1 2 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	4	1			1	2 1	3					1 1	2	3 2 3 3						1				1	2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1			1	2 1												2 2 1 2		1	1			3	1
24 HEALTH SERVICES (SIC Major Gp 80)		1			1			1					3 1 2 3			X			?	3	1			1	1
25 GENERAL PUBLIC																X								2 R	1 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF DEPT. OF DEFENSE (excl. Stds Labs) / USERS / MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	U S E R S	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B) 13	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY	2			2 ? 3 ? R		2 1 2 R		4 R	1	4	1									2 R			
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1		2	3 R				3 R		4				1 R				2 R	4 R	3 R	4 R	1 R	1 R	1 R	
3 VIBRATION & SHOCK	2 1 1		1	1 R		2 2 1 N R		2 R	1	2	1								2 2 2 R	2 R	2 R				
4 SURFACE FINISH	2 2		3 3	3 3 R		3 1 2 R		3 1 2 R		3 3	2 2		3 3 R					3 3 R	3 3 R	2 2 R	2 2 R			
5 MASS, VOLUME & DENSITY	1		1 1 1	2 2 N R			1 R	3 R		1 3							1 R	1 R	2 3 N		1 R		1 R	1 R	
6 FORCE	2 2 2		2 3 2	3 2 R		2 4 R		2 4 R	1	3 4	2 3					2 1 R	2 1 R	2 2 R	2 3 R	2 2 R	2 3 R	2 3 R	2 4 R		
7 FLUID FLOW	4 1 3		2 2	2 2 R		2 2 R		3 R	2	4	1	1		1 R	1 R		1 R		1 R		4 R	3 R			
8 PRESSURE	1 1		2 2	2 2 R		2 3 1 R		1 R	?	4 1 4	1 1									2 1 R	2 1 R			
9 TEMPERATURE			1	2 R		1 1 R		2 1 3 2 R		4									1 R	1 R	2 R	1 R		
10 HUMIDITY & MOISTURE	2 1 2		2 1 2	2 1 2 R		2 1 2 R		3 R		4	2					1 R			1 R	2 2 R	2 R			
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 2 2 1		3 1 3 1	2 1 2 R		3 2 3 1				3 2 3 2 1	3 2 3 1		2 1 2 1				2 1 2 1							
12 CRYOGENICS	2 1 2 2		3 1 2	2 R		3 4 2 R	3 1 2	2 1 1 R	1 2	2 1 3 2	2 1 2		2 1 2				1 1 R				1 1 R	1 1 R		
13 ELECTRICITY	2 1 2 2		2 1 3 2	3 1 2 R		2 2 2 R		3 1 3 2 R	1	3 ? 4 2			2 1 2 2				3 1 1 2 R	3 1 1 2 R	3 1 3 2 R	3 1 4 3 R	3 1 3 2 R	3 1 2 R	3 1 2 3 R	
14 ELECTROMAGNETICS	2 2 3 2		3 2 3 4 1 2	1 2 R		2 1 3 1 R		3 2 4 2 R	2 2 1 1	2 2 4 1	3 2 2		2 2 2 1						3 2 2 R	3 2 4 2 R	3 2 4 2 R	3 2 2 R		
15 MEDICAL ULTRASONICS																								
16 ACOUSTICS	3		1	2 2 4 2 R		1 R		X	X	4	X		X	X	X	X	X	X	X	4 R	X		X	X	X
17 RADIOMETRY & PHOTOMETRY	2 1 2		2 1 2	2 1 2 R		2 1 1		4 1 3 R	1 1	4 1 4	1 1 1		2 1 2							2 1 1 R				
18 SPECTROPHOTOMETRY	2 2 3 2		2 1 2 2	2 2 R		2 1 2				2 ? 4 3	1 1 1										2 1 1 2 R			
19 FAR ULTRAVIOLET RADIOMETRY	?		?	1						2	?													
20 OPTICS	2		2	4 R		1 3 R		1 R		4	1							3 R	1 R		4 R		2 R	
21 LASERS	4		1	3		3				4	2									4	2	2	2	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	2 3 2			2 3 2		2 3 3				2 2 3 2	2 2 3 2									2 2 3				
23 SURFACE PROPERTIES	3 2 3		2 2 2	3 2 2		3 2 2		2 2 1 2 R		4 2 3 3	3 2 2						2 2 2	3 2 2		3 2 2	3 2 2	3 2 2		
24 IONIZING RADIATION	1		2	3 R		3 R		2 R	2	4	3					1	3 R	4 R		2 R	3 R	2 R	2 R	1
25 AVERAGE	3 2 2		3 1 2	3 1 2 R		2 1 3 1 R	1	3 1 3 1 R	1	3 1 7 1	3 1 2 1		2 1 1 1				2 1 1 R	3 1 2 1 R	3 1 2 R	3 1 4 2 R	3 1 4 2 R	2 1 2 1 R	2 R	1 R	

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
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D - (IN)ADEQUACY OF SERVICES

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USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
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4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

R = Flow of requirements info dominates

? = Unknown, X = Not studied, Blank = 0

Sector 11. Civilian Federal Government Agencies (excl. standards labs and regulatory agencies)

Congress and its agencies. Judicial branch. Executive Office of the President. Depts. of Agriculture, Housing & Urban Development, Interior, Justice, Labor, State, and Treasury. Dept. of Commerce, excluding NBS, but including the National Oceanic & Atmospheric Admin. (and therefore the National Weather Service and National Ocean Survey), Patent Office, and Office of Telecommunications. Dept. of Health, Education & Welfare, including the National Institutes of Health and National Institute for Occupational Safety & Health. Dept. of Transportation, including the Coast Guard and Federal Aviation Admin. Energy Research & Development Admin., General Services Admin., National Aeronautics & Space Admin., National Science Foundation, Tennessee Valley Authority, U.S. Arms Control & Disarmament Agency, U.S. Information Agency, U.S. Postal Service, and Veterans Admin.

Note that the standards laboratories operations of these agencies are accounted for in sector 8, and that the regulatory agencies of sector 9 are excluded here; however, there are some mixed regulatory-operational agencies (such as Coast Guard and FAA) which *are* included.

Every space launch and every landing of a commercial airliner involves a very sophisticated civilian federal government measurement activity. The National Weather Service exists solely to measure and to interpret for the future the meaning of today's measurements. The National Ocean Survey, formerly the Coast and Geodetic Survey, is a pure measurement activity, the oldest (1807) in the Federal Government.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO CIVILIAN FEDERAL GOVERNMENT AGENCIES — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY	LENGTH & RELATED DIMENSIONAL MEASUREMENTS	VIBRATION & SHOCK	SURFACE FINISH	MASS, VOLUME & DENSITY	FORCE	FLUID FLOW	PRESSURE	TEMPERATURE	HUMIDITY & MOISTURE	THERMODYNAMIC PROPERTIES OF FLUIDS	CRYOGENICS	ELECTRICITY	ELECTROMAGNETICS	MEDICAL ULTRASONICS	ACOUSTICS	RADIOMETRY & PHOTOMETRY	SPECTROPHOTOMETRY	FAR ULTRAVIOLET RADIOMETRY	OPTICS	LASERS	PHYSICAL PROPERTIES OF ATOMS & MOLECULES	SURFACE PROPERTIES	IONIZING RADIATION	AVERAGE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.	3	4	2 2	2 3 2	1	2	2	3 3 2	1 3	2 1 2	3 4 4	3 4 2	2	3 4 1	2	2	2 3 1 2	2 2 3	2 1 2	2	4 4	4 4 3 4	3 3 3	4	3 3 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	2																								1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2	2 3	3 1 2	1	2 3	2	3 1 1	1	2	3 2 1	2 2 2	2 1 2	2 2 3 1		2	2 3 1 2	2 3 2	?	2	1	2 2 1 1		4	2 1 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3	3	2 1 2	2 1 2	1 1 2	1 2	2	3 4 1	4 1 4 2	2 3	2 1 3	2 3	3 1 3 2	3 2 4 1	2	2 3 1 2	4 1 3 2	2 3 3	2 2 2	4	3	3 2 3 2	3 1 2 3	4	3 1 4 1
5 NBS	3 3	1	2 1 1 2	2 1 1	2 1	2 4 2	3 3	4 2 3 1	2 3	2 3	2 3 4 3	2 4 2 2	3 1 3	3 2 3 1	1	2 3	3 1 3 2	2 3 2	2 3	4 1 2	4 4	3 4	3 2 2	4 4	3 1 3 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	2											2 1 2								2					1
7 STATE & LOCAL OFFICE OF WEIGHTS & MEASURES (OWM's)										1															
8 STANDARDS & TESTING LABORATORIES AND SERVICES	3	2	2 1 2	2 1 2	1 3	3 4	2	2 2	3 2 2	2		2 2	3 1 3 2	3 1 3 1		2	2 2 2 2	2 1 2 2	2 2 2	1	1		2 1 2	3	3 1 2
9 REGULATORY AGENCIES (excl. OWM's)	3 R		1		3 3	2 R	R	1 R			1 2 2	1 2	3 1 2 3	3 2 3 1	?	2 R	2 1 2 2	3 2 1 2	2 2 1 2	3 R	3 R			4 R	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	1		1	2 2		2 3	1	1 1		2	3 2 1	2 2		3 2		X	1 1 1 1	1 1 1	?	1	2	2 2 3 2	3 2	3	3 1 2
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	4	4	2 2 2	3 1 3	1 1 3	2 4	4	4 1 4 1	4	4	3 1 3 4	2 1 3 2	1 1 4 2	3 1 4 1	3	3 3 2	3 1 3 2	2 3 4	2 2 2	3	3 2	3	4 2 3 3	4	3 1 7 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1				2	1					2 1 2								1 R				1 R	1
13 INDUSTRIAL TRADE ASSOCIATIONS				2 2			2		?		2 2 3	2 3 2		1 1 1		2 R	2 1 2	2 2 1 2			1				2 1 1 2
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)		1					2		2 1 4 R	3														3	2
15 CONSTRUCTION (SIC Div. C)		1			1	2 ? 1 ?	2		3 R							2				1					1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER LEATHER (SIC 20-26, 31)				4 1 2	1	2 1				2						1					1			2	1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					1	2 1				1	1 2 3	1 1 1							2 2 1 2	2	1		2 2 2	4	2 2 2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 39))				2	1	2 2							3 1 2							3	1		2 2 2	4	2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2	1	4 1 3	2	2 3	1		2 1 1	2			3 1 2 2			2				1					3 1 1
20 ELECTRIC AND ELECTRONIC EQUPMT (SIC Major Gp 36)		1	1	2		2 2			2 1 1	1			2 3 2	1 2 4 2		2	4 1 3 2			2	3	3 4 3	2 2 2	2	3 1 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2	2 2	1	1	2 2	2 1 4	3 2	2 1 1	1		1 1 1	2 1 3 2	2 1 3 2		1				2			2 2 2	1	2 1 2
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3	2	1		1	2 3	2 1 4	3 1	2 1 4 R			1 1	2	2 2 3 2		1			1	3	1			4	2 1 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1			1	2 2		1	2 1 R											1	1			3	1
24 HEALTH SERVICES (SIC Major Gp 80)		1			2 1 1		1			1			1 R		3	2			1	1	2			2	1
25 GENERAL PUBLIC		1 R	1 R				2 R	2 1 R	4 R							2 R	2 1 1 2 R			1 R	1 R			2 R	2 R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF CIVILIAN FEDERAL GOVERNMENT AGENCIES — USERS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Req.Aq.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Req. Aq.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, Ial I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY	2			2 R	2 3 R 2	1 R		3 R	1	1	4									3 R	2 R				1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1		2	2 R	1 R			1 R		1	4	3		1	2			1		2 R	3 R	3	1 R	1 R	2
3 VIBRATION & SHOCK	2 2 1		2 2 2	2 2 1 R	2 2 1 R 2			3 2 3 R	1	2 2 2	2 2 2									2 3 1 R	2 2 1 R	3 2 2 R	2 2 1 R	1 R	1
4 SURFACE FINISH	2 3		3 3 2	1 2 R	3 1 3 R 2					2 2	3 1 3		2 1 2 R			2 2		3 2	3 2			1 R		
5 MASS, VOLUME & DENSITY	2 1 1 N	2 2 2 2	1	2 1 R	2 2 R			3 R			1 1 3	1 R			1 R	1 R	1 R	1 R	2 1	1 R		1 R	1 R	1	1
6 FORCE	2 2 2		2 4 2	2 R	2 4 R			2 3 R	4 2	2 2	2 4	4			2 R	1 R	1 R	1 R	1 R		1 R	1 R	1 R		1
7 FLUID FLOW	3		2	2 R	2 2 R			2 R	2	2	4	2		3	3		1 R		1 R		4 1 4 R	4 1 4	1	1	4
8 PRESSURE	2 2		3 2	2 2 R	2 2 R			2 1	?	1	4 1 4 1			2	1						4 2 3	4 2 4	1		3 4
9 TEMPERATURE	1		1	2 R	2 1 2 R			1 R			4	2		4	3	1	1	1	2	1	2	4	2	1	4
10 HUMIDITY & MOISTURE	2 1 3		2 1 3	2 1 3	2 1 2 R		2	1		2	4	2		4	3	3			2	3	2	4	1	2	1 4
11 THERMODYNAMIC PROPERTIES OF FLUIDS	3 2 2 4		3 2 3 4	2 1 2 R 4	3 2 3 4					2 1 2 3	3 1 3 4		2 1 2 3				2 2 2 3				2 1 2			
12 CRYOGENICS	3 1 3 2		2 2 2	2 2 R 2	2 1 2 4 R 2	2 1 2 2		2 2	1 1 2 2	2 1 2 2	2 1 3 2	2 1 1 2	2 1 3 2				1 1 1				1 1 1 1	1 1 1			
13 ELECTRICITY	2 1 1 2		2 2 2	1 1 2 2 R	2 2 1 R 2			3 1 2 1 2 R 2	2 1 1 2	1	1 1 4 2	1 1 1 2	1				3 1 1 2	3 1 2 2	3 1 3 2	3 1 3 2	3 1 3 2	3 1 2 2		3 1 2 2	1
14 ELECTROMAGNETICS	2 2 3 1		2 2 3 1	2 2 4 R	2 2 3 1 R			2 2 4 2 R	2 3 1	3 2 2	3 1 4 1		3 2 3							3 1 3 2 R	3 1 3 2 R	3 2 3 1 R			
15 MEDICAL ULTRASONICS	2				2 3 1						3													3	1
16 ACOUSTICS	2		2	2 1 3 R	2 3 R			2 R	1	X	3 3 2	1	3 1 2 2	1	1					1 R	3	3		1	3 1 2 2
17 RADIOMETRY & PHOTOMETRY	2 1 2 2		2 1 1 2 2	2 1 2 R	3 1 2			2 1 2	2 1 3 2	1 1 1	3 1 3 2		2 1 2 2							2 1 1 2				1	2 1 2
18 SPECTROPHOTOMETRY	2 1 3 2		2 1 2 2 2	2 2 2 R	2 1 2			2 3 2 4 R			2 3 3 4	2 2 2				2 2 2 2	2 2 2			2 2 1 2	2 2 1 2	2 3 1 2	2 3 1 2	2	
19 FAR ULTRAVIOLET RADIOMETRY	2 2 2		?	2 2 1 2	2 2 1 2				2 3 2 2	4 2 1 2	2 2 2									1		2 2 1 2		2 2 1 2
20 OPTICS	1		1	3 R	2 R	2 R		1 R	1		3	1						4 2 R			4 2 R	2 R		2 R	1
21 LASERS	3 3 2		3 2	3 2	3 3				2	3 2 2	3 2	1	1				1	1	3 1	1	3 3 2	1	3 1	3 2	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	4 3 3 2			2 1 3 3	1 4 4 2					2 2 2 2	3										4 3 3 3				
23 SURFACE PROPERTIES	3 2 3 3		2 2 1 2	3 2 2	3 2 3			2 2 1 2		2 2 2 3	4 2 3 3						2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2				
24 IONIZING RADIATION	3		4	3	4			2 R	4	2	4	1		2 R			1 R	4 R	4 R		1 R	4 R	2 R	4 R	2
25 AVERAGE	3 1 2 1		2 1 2 2	2 2 2	3 1 3 1	1		2 2 1	2 1 2	2 1 1	3 7 2	2 1 2 1	2 1 2	2	1	1	2 2 2	3 2 1	3 1 2	3 1 2 1	4 1 4	1	2		2 3

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
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4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
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4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

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A - MAGNITUDE OF TRANSACTIONS

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3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 12. State and Local Government Agencies (excluding Offices of Weights and Measures and regulatory agencies).

All aspects of state and local governments, with some major exclusions: Public schools, colleges and universities (sector 1). Offices of Weights and Measures (sector 7). Regulatory agencies (sector 9). Public health departments (sectors 9 & 24) and publicly run hospitals (sector 24).

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO STATE & LOCAL GOVERNMENT AGENCIES — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.							2	2 1			2 1 3	2 1 2				1		1 ? 1							1	2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																										
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS						3 2 2	2	1			2 1	2 2 2				1		2 2 2 2			1				3	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp. 38)	1	2			1	1 2	3	2 1 1	2 1 2	1		2 1	3 1 2					2 2 1 2		2	1				1	3
5 NBS	1					2 3	2 1 2			1	3 2 2	2 1 2 2	3 1 2			2		1 1 1 2		1 1	1 3 1				2 1 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES												1 1 2								2						1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	1	1			3 1 3 1	3 2			1 1 1 2	1		1 1 2													3 1 1 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES		1			1	2 2	2	1		1		2 2	3 1 2					2 1 2 2		1						1
9 REGULATORY AGENCIES (excl. OWM's)						2 R	3 1 3 2 R		?			1 2 2	3 1 3 R			1 R				1 R	4 2				3 R	1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)							1																			
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		3			1 R	2 4	2		2	2		2 1 1 2	1 1 2			1		2 2 2 2		1	1				1	2 1 2 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	2	4			3	3 ? 3 ? ?	3 2 3 2	1	1	1			2 ? 2 2			2		2 2 2 2		1	1 3 1 2			1	3 2 6 2
13 INDUSTRIAL TRADE ASSOCIATIONS						2 ? 2 2 R						2 1 1 2						2 2 1 2			1 3 1				2 2 1 2
14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)		1			1	?	1			1																1
15 CONSTRUCTION (SIC Div. C)		3			2	?	2									2										1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)						?										2										1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)						?						1 1 2				2										1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)					1	?										2										1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2			1	1 3	1	1	2 1 1	1						2										1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)						?			2 1 1							1				1						1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		1			1	2 3	2	1	2 1 1			1 1 2				3 1 2										2 1 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2	2			2	2 3	3					1 1 2	2			3									1	1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1	1			2	2 2		1													1 3 1					1
24 HEALTH SERVICES (SIC Major Gp 80)																2				1	1 3 1				1	1
25 GENERAL PUBLIC	1 R	2 R			1 R		1 R	2 1 R				3 2 1 2 R								1 R	1 2 1 2 R				2 R	1 R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF STATE & LOCAL GOVERNMENT AGENCIES — USERS / MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWMs & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING, MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY							2 R		1			2												1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS				1 R			2 R			1	1	4		2 R	4				1 R		1 R	2 R	1 R	2
3 VIBRATION & SHOCK																								
4 SURFACE FINISH																								
5 MASS, VOLUME & DENSITY							2 R	1 R				3			1 R			1 R	1 R			1 R	1 R	
6 FORCE			1	1 R	2 2 R		2 R	3 3 R	1		2	3 ? 3 ?	3 ? 2						1 R					
7 FLUID FLOW	1		3	2 R				2 R	3	2	1	3 2		1	2	1	1		1			2		
8 PRESSURE												1												
9 TEMPERATURE				1 R								1												
10 HUMIDITY & MOISTURE							1 R	1 R				1												
11 THERMODYNAMIC PROPERTIES OF FLUIDS																								
12 CRYOGENICS	2 1 2		2 2	2 1 R	2 1 2 R	1 1 2	1 1 2 R	2 1 2 R	1 2 2		2 1 2		2 1 1 2				1 1 2			1 1 2	1 1 2			
13 ELECTRICITY				2 1 2 R	2 1 2 R			3 1 2 R	1			2 ? 2 2												
14 ELECTROMAGNETICS																								
15 MEDICAL ULTRASONICS																								
16 ACOUSTICS	1				1 R			2 R	1	x		2		1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R		2
17 RADIOMETRY & PHOTOMETRY																								
18 SPECTROPHOTOMETRY	1		2 2 1 1 2	1 R	2 2 1 2				2 1 1			2 2 2 2	2 1 1 2											
19 FAR ULTRAVIOLET RADIOMETRY																								
20 OPTICS				1 R		2 R		1 R			1 R	1												
21 LASERS				1 R	1 3 1 2 R				1			1 3 1 2	1		3 1 R	3 3 1 R	3 3 1 R	3 3 1 R		1 R		1 R	4 3 1 R	1 R	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																								
23 SURFACE PROPERTIES																								
24 IONIZING RADIATION			1							1 R	1 R	1										2 R	2 R	1 R
25 AVERAGE	1		1	1 R	2 1 1 R	1	1 R	1 R	1	1	1	3 2 6 2	1	1	2	1	1	1	1		1	1	1	1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, x = Not studied, Blank = 0

Sector 13. Industrial Trade Associations

Industrial, business, or trade associations, such as the American Petroleum Institute (API), Electric Power Research Institute (EPRI), Manufacturers Council on Color and Appearance (MCCA), and the Electronic Industries Association (EIA).

These associations are not major users of measurement goods and services, *per se*. Rather, they are a major channel for coupling the measurement needs of the industries they serve with the measurement supply capabilities of other sectors of the measurement system. They are substantial suppliers of measurement needs information and of measurement system coordination efforts. They often function as documentary specifications organizations. This sector is listed this low in the numerical sequence only because it is closely affiliated with the industrial sectors that follow and because it often plays a pivotal role in the working measurement system. Understanding this sector more thoroughly is an important future objective for NBS in improving its support to the national industrial measurement system.

Of all of the sectors in these matrices, this is the one for which the matrix entries are likely to be most in error. It is also one which is likely to display the most redundancy and double counting with respect to the other sectors. Specifically, the efforts of industrial trade associations have often been accounted for as part of the activities of the economic sector in which their memberships lie, and data for this sector as a separate entity omitted. To remedy this defect, all injunctions against double counting have been removed when dealing with this sector.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO INDUSTRIAL TRADE ASSOCIATIONS — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY 1	LENGTH & RELATED DIMENSIONAL MEASUREMENTS 2	VIBRATION & SHOCK 3	SURFACE FINISH 4	MASS, VOLUME & DENSITY 5	FORCE 6	FLUID FLOW 7	PRESSURE 8	TEMPERATURE 9	HUMIDITY & MOISTURE 10	THERMODYNAMIC PROPERTIES OF FLUIDS 11	CRYOGENICS 12	ELECTRICITY 13	ELECTROMAGNETICS 14	MEDICAL ULTRASONICS 15	ACOUSTICS 16	RADIOMETRY & PHOTOMETRY 17	SPECTROPHOTOMETRY 18	FAR ULTRAVIOLET RADIOMETRY 19	OPTICS 20	LASERS 21	PHYSICAL PROPERTIES OF ATOMS & MOLECULES 22	SURFACE PROPERTIES 23	IONIZING RADIATION 24	AVERAGE 25
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.				2 3 2			2	2 2		1	3 2 3	2 3	1	3 2		1	2 3 2	1 1			1				2 2 1 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS				2								3 3 1 3						1 3 1 2							
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2		3 2 3	1	3 4 2 R	2 1 3 2	2 3	1 1 1 2	1	3 2 2 1	2 1 3 2	2 1 2 2	4 2 3 2	?	3 2 3 2	3 2 1 2	2 2 2 2			1				3 1 2 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)		2		3 1 3		?	2 2	2 1 2 1	4 2 2	1	2 1 1	2 3 2	2 1 2 2	2 2 1		2 1 3 2	3 1 3 2	2 1 2 2			3				2 1 2 1
5 NBS		3		3 1 2 2	2 1 1	1 2	2	2 1 2 1	2 1 2 2		2 2 3 3	2 1 4 2	1 1 2 2	2 2 1 1	2 1 1	3 2 3 1	2 1 4 2	2 2 4 4			1			2 2 3 2	2 1 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES												2 1 2 2													1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)						2 2				1		2 1 3 2													1
8 STANDARDS & TESTING LABORATORIES AND SERVICES				3 1 3		1 2	1					2 2		2 1 2 1		3 4 2	2 1 2 2	2 1 2 2							3 2 1
9 REGULATORY AGENCIES (excl. OWM's)					1 R	3 2 2 R	1 R					2 1 3 2	2 1 2 2	2 2 1 R		3 1 4 3 R	2 1 2 2	2 3 2 R			2				2 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)				3 3 R							2 1 2 1	2 1 2 2	2 1 2 2	2 2 1 1		X	2 1 2								2 1 1 1
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.				2 1 2 R							2 1 2 3	2 1 3 2	1	3 2 3		3 1 2 2	2 1 2				1				2 1 1 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)						3 ? 2 2						2 1 1 2						2 1 1 2			1				1
13 INDUSTRIAL TRADE ASSOCIATIONS		3		3 2 1 3	1 2	2	2	2 3	2 1 1	2	3 2 3	2 1 2 2	2 2 2 2	2 2 3 1	1	2 1 3 2 R	2 1 4 2	2 3 1 2			1				2 1 2 1
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)		3 R			2 1	2 1	3		2 1 1	1															1
15 CONSTRUCTION (SIC Div. C)						2 2	3									2	1				2				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				4 1 4 2 R	1	2 3			2 1 1	1						2		2 2 2 2			2				3 1 2 2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)		3 R		3 2 2 2 R	2 1	2 2		1	2 1 1		2 1 1 2 3	2				2					2				2 1 1 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2		4 4		2 3			2 1 1							2					2				2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2		4 4		2 3			2 1 1				1	1		2									2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)				4 4		2 1			2 1 1				2	3 2 2		2	3 1 2				3				3 1 2 1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		1		2 1 3	2 1 2 1 R	2 3	2	2	2 1 1			1 2	2	3 2 2 2		4 4	1				2				3 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)						2 3	3	2 2	2 1 1		2 1 1 1	2	2	1 2 1		3					2				2 2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)					3 R	2 3			2 1 1												3				1
24 HEALTH SERVICES (SIC Major Gp 80)				2 2 3 R																	2				1
25 GENERAL PUBLIC					1 R	1 R		1 R				2 2 1 2 R				2 1 1 2 R									1 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF INDUSTRIAL TRADE ASSOCIATIONS / MEASUREMENT SECTOR	USERS	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES REGULATORY AGENCIES (excl. OWM's) 8	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg. Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	TRADE ASSOCIATIONS INDUSTRIAL 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 17	18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, Ba1 I, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY																									
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS			2	3	3 R	3			1	1			3	3	1		3	3	3		2				
3 VIBRATION & SHOCK																									
4 SURFACE FINISH	3 3			3 3	2 3	3 1 3 2 R			2 1 2 R	3 2 R	2 2		3 2 3			4 3 2	2 2 2	4 3	4 4	3 1 3	3 3			2 1 2	
5 MASS, VOLUME & DENSITY		2 2 1 2	2 1 3 1		2 1 2 R			2 1 2 R	2 2 3	1 2			1 2 1			2			3				3		1
6 FORCE			2 2 4 2	?	2 2 R		1 R	3 3 R	2 ? 3 2		2 ? 2 2 R		2			2			3				3		1
7 FLUID FLOW	1			3	3 R	2 1 2 R			3		2		2	3	3		3				2	3			
8 PRESSURE	1			2	2 1 3 2 R	2 1 2 R							2 3												
9 TEMPERATURE	1 1			2 2	1 R	2 2			?		?		2 1 1	1 1		1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1		
10 HUMIDITY & MOISTURE	1				1	1		1					2	3		3									
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 1 3			2 1 3		2 2 3				2 1 3	2 3		3 2 3				2 2 3							
12 CRYOGENICS	2 3 2		2 1 3 2	3	2 1 4 2 R	2 1 2 2	2 1 3 2	2 1 2 2	2 1 3 2	2 1 3 2	2 1 3 2	2 1 2	2 1 2				1 2			1 2	1 2	1 2			
13 ELECTRICITY	1		3 1 4 2	3 1 4 2 R	2 1 3 2 R				3 1 2 2 R				2 2 2						1	2	2	2			
14 ELECTROMAGNETICS	2 2 2 1		2 2 3 2	3 2 R	2 2 2 R			1 1 2 1 R	2 3 2	2 2 2	2 1 1	1	2 2 3 1						1	2 2 3 1	2 2 3 1	2 2 3 1			
15 MEDICAL ULTRASONICS					1								1												
16 ACOUSTICS	1		2 2 3 2	2 1 3 R	2 1 4 1 R			3 1 3 2 R	2 1 4 2 R	X	2	R	2 1 3 2 R	1	1	1	1	1	1	1	1	1		2
17 RADIOMETRY & PHOTOMETRY	2 1 2 2		2 1 2 2	3 4 2	1 3 1 4 2			2 1 2 2	2 1 2 1	1 1 1	2 1 2		2 1 4 2		1					2 4 2	1			1 1	
18 SPECTROPHOTOMETRY	1		2 2 2 2	2 2 2 R	2 1 2			2 1 2 2	1 2 2 1		2 1 2	2 2 1	2 3 2 1			2 2 2	2 1 2 2			2 1 2	2 1 2	1 2 1	2 2 1 2	2 2 1 2	?	
19 FAR ULTRAVIOLET RADIOMETRY																									
20 OPTICS																									
21 LASERS	1			1	1	1 R			4 3	1	1	1 3 1	1		1	1	1	1		1		1	1	1	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION																									
25 AVERAGE	2 1 1	1	2 1 3 2	2 1 2 2	2 1 2	2 1 2	1	3 1 1 2	2 1 2	2 1 1	1 2 1 2	1 2 2	2 1 2	1	1	1	2 1 1	1	2	2 1 2	1 2	1 1	1	1	1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
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D - (IN)ADEQUACY OF SERVICES

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USERS

C D
A
B R

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4 = Major

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Sector 14. Agriculture, Forestry, Fishing; Mining (SIC Divisions A & B).

Crops--grains, cotton, tobacco, sugar, vegetables, fruits, nuts, ornamentals, horticultural specialties. Livestock. Agricultural services, including landscape & horticultural services. Forestry--timber tracts, nurseries, gathering of miscellaneous forest products. Fishing, hunting and trapping. Mining--base & precious metals, uranium, mining services. Coal mining. Oil & gas extraction. Stone, gravel, clay, chemical, and fertilizer minerals.

These extractive industries tend to place relatively light demands upon the measurement system. On the other hand, measurements play many critical roles. Measurements of product quality (such as of moisture in grain) are of major economic significance in agriculture. The fishing fleet depends upon navigational measurements to know where it is. The forester measures the amount of timber in a stand. The miner measures the metal content and location of his ore. The petroleum industry employs many remote measurement means to determine where to drill for oil and gas.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO AGRICULTURE, FOREST, FISHING; MINING (SIC A&B) — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY 1	LENGTH & RELATED DIMENSIONAL MEASUREMENTS 2	VIBRATION & SHOCK 3	SURFACE FINISH 4	MASS, VOLUME & DENSITY 5	FORCE 6	FLUID FLOW 7	PRESSURE 8	TEMPERATURE 9	HUMIDITY & MOISTURE 10	THERMODYNAMIC PROPERTIES OF FLUIDS 11	CRYOGENICS 12	ELECTRICITY 13	ELECTROMAGNETICS 14	MEDICAL ULTRASONICS 15	ACOUSTICS 16	RADIOMETRY & PHOTOMETRY 17	SPECTROPHOTOMETRY 18	FAR ULTRAVIOLET RADIOMETRY 19	OPTICS 20	LASERS 21	PHYSICAL PROPERTIES OF ATOMS & MOLECULES 22	SURFACE PROPERTIES 23	IONIZING RADIATION 24	24AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.					1		1 1 2			3	2 2 1 3					2								2	1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	4 1 3																								1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 1			X	3 2 2	2 3 2	1		3 1 3 2	2 1 1					1								2	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3 3	2			1 1	3 1	3 3 2	3 1 2 1	4 1 3 2	3 2 4 2	1 1 1 2	1	1			3		1						3	3 1 3 2
5 NBS	4 4	4 1 4 2			2 2 1	1 1	2 2	1	2 1 2 2	3 3 3 2	2 3 1 2														4 1 2 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	4																								1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					2	2 3			1 2 1 2	2															1
8 STANDARDS & TESTING LABORATORIES AND SERVICES					1	3	2 3 1 2	1	1							2								1	1
9 REGULATORY AGENCIES (excl. OWM's)	2 R				1 R	3 1 2 R	3 1 2 R		3 1 2 R				1 R			4 2 4 R								3 R	4 2 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)							1 R									X									
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		1					3	2	4	4														2 R	2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		2 R					1									1 R									1
13 INDUSTRIAL TRADE ASSOCIATIONS		3					3		1 1	3						1									1
* 14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	4	2 1 3			2 4	2 4	4	4	3 1 4	4	1 2 3	1	2					1						4	2 5
15 CONSTRUCTION (SIC Div. C)		1			1	2 1	1																		1
16 FOOD/TOB/TEXTILE/ APPAREL/L3R/FURN/PAPER/ LEATHER (SIC 20-26, 31)					3	2 3				2						2									1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					3	2 3	4	2	1	2	2 1 3	1												3	2
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2 1 4			1	2 3	1	1																1 R	2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 4			1	2 1	3	1	1	2 3 2			1			2									2 2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)						2 3							1												1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		1			2	2	1	1	1				1			1									1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2				4	3	3 2 4 2	2	4	2		1	1											1 R	2
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H bal. I, 27)		1			2	1 2			1															3	1
24 HEALTH SERVICES (SIC Major Gp 80)																1								2	1
25 GENERAL PUBLIC					1 R																				1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF AGRICULTURE, FOREST, FISHING; MINING (SIC A&B)

USERS

MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (excl. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1,27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY				2 2 ? R	2 2 1 R	1 R		1 R	2					4						2 R					
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS			2 1 2	2 R	3 1 2 R						1	1	3 R	2 1 3	1	1		2 1 R	2 1 3 R		1 R			
3 VIBRATION & SHOCK																								
4 SURFACE FINISH																								
5 MASS, VOLUME & DENSITY	1		2 2		3 1 R		2 R	1 R				1	2 1	2 4	1 R	4	4	4	1 R		1 R	4 R	2		1
6 FORCE			2 1					2 2 R	2 1	1 1 ? ?		?	2 1	2 4	2 2	3	3	2	2		1	2 3	2		3 1 2
7 FLUID FLOW	1		2 1 3 2	2 R	2 1 2 R			1 R	2	1	2	1	3	4	1		4	1	2 R		2	4			
8 PRESSURE			2	3 R										4			2	2 R	2		3	4			
9 TEMPERATURE			3 1 1	3 2 2 R	3 3 2 2 R				2 1 1		2 1 4 R		2 1 1	3 1 4					1		1 R	2 R			
10 HUMIDITY & MOISTURE	2		2	2 2 R	2 2 3 R		3 R				3	1	1	4		2	1		2 R			1 R			
11 THERMODYNAMIC PROPERTIES OF FLUIDS	1 1 3				1 1 2									1 2 3							1 1 2	1 1 2			
12 CRYOGENICS			1											1			1 R				1 R	1			
13 ELECTRICITY														2				1	1 R						
14 ELECTROMAGNETICS																									
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS	2			2 R	1 R			1 R	2	X				4						2 R					
17 RADIOMETRY & PHOTOMETRY																									
18 SPECTROPHOTOMETRY														1											
19 FAR ULTRAVIOLET RADIOMETRY																									
20 OPTICS																									
21 LASERS																									
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION	1		2	2 R	1 R				3	1	3			4			2	1				1		1 R	1
25 AVERAGE	1		2 1 1	1 R	2 2 1 P		1 P	1 R	1	1	2	1	1	2 5	1	2	2	2	1	1	1	2	1		1

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4 = Major

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Sector 15. Construction (SIC Division C)

General building contractors. Heavy construction contractors. Special trade contractors--plumbing, heating, air conditioning, electrical, water well drilling, etc. Note that engineering and architectural services relevant to this sector are included here.

The construction industry is the third largest user of measurement-related activity by the dollar volume of value-added. All construction involves a virtually continuous series of dimensional measurements to determine where the construction is to take place, to be sure that the pieces will fit, and to determine when the job is done (as in grading for a roadbed). Concrete and gravel are delivered by the cubic yard. Building construction requires installation of measurement devices for controlling heating, air conditioning, and other building systems.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO CONSTRUCTION (SIC Div. C) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)		1				1	2 1									3	1			1	4 1				1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2				3 2 2	2 1 2		1	2			1			2 1 4	1			2	1				2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	1	4				3 1	2 1 4	3 1 1	3	2		1	2			3	1			3	1				4
5 NBS		1				1 1	2 1 2	1								2	1			2 1 2					1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																				2					1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					1	2 1																			
8 STANDARDS & TESTING LABORATORIES AND SERVICES		1				3 3	2	1								3				2					1
9 REGULATORY AGENCIES (excl. OWM's)						3 1 2 R	3 1 2 2 R						1 R			4 1 3 2 R				2 R	1 R				4 1 1 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		1 R					1 R									X									
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		2			1 R	2 R	3	1	3	3						1									1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		4			1 R		2									1 R					3 1 R				2
13 INDUSTRIAL TRADE ASSOCIATIONS		1					3									1	1				1				1
14 AGRICULTURE, FORESTRY, FISHING: MINING (SIC Div A & B)		1			1 R	2 2	1																		1
* 15 CONSTRUCTION (SIC Div. C)	1	4			3	2 3	1	1	1	1		1	1			2 1 3 2	1			3	1				6
16 FOOD/TOB/TEXTILE/APPAREL/LBR/FURN/PAPER/LEATHER (SIC 20-26,31)		2														2 R									1
17 CHEM/PETROL/RUBBER/PLASTICS/STONE/CLAY/GLASS (SIC 28-30,32)		2			3	2 3	1		1 R			1				1 R									1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1			1	2 3										1 R				4 1 2 2					1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2			2	2 2	2		1	1						2									1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)									2				1				3			3	1				1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)					1	2	1					1				1									1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2				2	2	1		1 R				1							2 R					1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1			2 R	1 2		1									1								1
24 HEALTH SERVICES (SIC Major Gp 80)									1							1									1
25 GENERAL PUBLIC		1 R							2 R																1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF CONSTRUCTION (SIC Div. C)

USERS

MEASUREMENT SECTOR

MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (O&M's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. O&M's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. O&M's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, ba1 1, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY															1										1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS			1	1 R						1	1	3		1	4			1 R	1 R			1 R		3
3 VIBRATION & SHOCK																									
4 SURFACE FINISH																									
5 MASS, VOLUME & DENSITY				1 R			1 R	1 R		1	1	2		1	3	1	1	1 R				2	1		
6 FORCE			2 1	1 R	2 1 R			2 2 R	2 1	1 ? 1 ?	2 ? 1 ?	?	2 2	2 1	2 3	1	1	1	1		1	2 2			3 1 2
7 FLUID FLOW	1		1	1 R	2 1 1 R			1 R	1	2	2	2	3	1	1		1		1 R		1	1			1
8 PRESSURE			1	1 R											1				1						
9 TEMPERATURE			1	1 R							3 R				1					1 R				1	2
10 HUMIDITY & MOISTURE			1	1 R											1			2 R	1 R						1
11 THERMODYNAMIC PROPERTIES OF FLUIDS																									
12 CRYOGENICS															1										
13 ELECTRICITY			1	1 R											1										
14 ELECTROMAGNETICS																									
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS	2 3		3	1 R	3 R			3 R	3	2	2	2	2		2 3 1 2						1 R	1 R	1	1	3
17 RADIOMETRY & PHOTOMETRY	1		1		1 R								1		1					1 R					1
18 SPECTROPHOTOMETRY																									
19 FAR ULTRAVIOLET RADIOMETRY																									
20 OPTICS			1	1 R	3 2 R	2 R		1 R	1		1				3			1 R		2 R		2			
21 LASERS	1		1	1 R	1 R				1	1			2		1					1 R					
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION																									
25 AVERAGE	1		1	1 R	1 R		1 R	1 R	1	1	1	1	1	1	6			1 R	1	1	1	1	1		1

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 16. Food, Tobacco, Textiles, Apparel, Lumber, Furniture, Paper, Leather (SIC 20-26, 31).

Food and kindred products--meat, dairy, canned, frozen, grain mill & bakery products, sugar, confectionary, beer, wine, liquor, soft drinks, seafoods, coffee, manufactured ice. Tobacco manufactures. Textile mill products--weaving, knitting, floor covering, and yarn & thread mills; felt & lace goods, paddings & upholstery fillings, tire cord & fabric, cordage & twine. Apparel and other textile products, including fur goods, belts, accessories, curtains & draperies, textile bags, canvas products. Lumber and wood products--logging camps, sawmills, cabinets, plywood, boxes, pallets, mobile homes, prefabricated wood buildings, wood preserving. Furniture and fixtures--wood, upholstered, and metal furniture; mattresses & bedsprings; office & public building furniture & fixtures; wood & metal partitions; drapery hardware, blinds & shades. Paper and allied products--pulp & paper mills, envelopes, bags, pressed & molded pulp goods, containers & boxes, building paper & board. Leather and leather products--tanning & finishing, footwear except rubber, gloves, mittens, luggage, handbags.

By both the estimates of the microstudy authors and macroeconomic analyses of measurement-related activity this rather large economic sector is only lightly dependent upon measurement activities. Only textiles and floor coverings in this group are sufficiently measurement intensive to rank in the top ten SIC sectors in terms of either percentage or total dollar amount of value added. The kinds of measurements required tend to be simple dimensional or process control parameters.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO FOOD/TOB/TEXTILE APPAREL/LBR/ETC. (SIC 20-26, 31) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.				2 3 2 2		1		1	1	3	X	1				2	1	2 3 2 2	2 2 1					2	2 2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		1		3 3 2 2	2 1	3 4 2		1	1	3 1 4 2	X	1				1		2 3 2 2 ?			1			2	2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	3		2 2 1	2 2 3 2	2 3	2	3 1 2 1	4 1 4 2	3 2 4 2	X	1	1	1		3	1	2 3 2	2 2 1 3		1			2	3 1 3 2
5 NBS				3 2 1 2	2 1 1	1 2		2 1 2 1	2 1 2 2	3 3 3 2	X							2 3 2 2	2 2 1					2 2 1	2 2 1 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					3 1 4 2	1 1			1 2 1 2	?															3 1 2 2
8 STANDARDS & TESTING LABORATORIES AND SERVICES				1		2 3		1	1							3		2 1 2 2	2 2 1 2					1	1
9 REGULATORY AGENCIES (excl. OWM's)					3 1 3 1 R	3 1 2 R	1 R		3 1 2 R				1 R	1 R		4 2 4 4 R	1	3 2 2 R	3 2 2 1		1 R			2 R	4 2 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)						2 1 R				1 R						X								1	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl.) Stds. Labs & Reg. Ag.)				2 2	1 R	1 R			1	3								2 2 2 2			1			1 R	1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)							1									1 R					3 1 R				1
13 INDUSTRIAL TRADE ASSOCIATIONS				4 3 2	2	2			1 1	3						1		2 2 2 2			1				1
14 AGRICULTURE, FORESTRY FISHING: MINING (SIC Div. A & B)		1			4	3				2						2									2
15 CONSTRUCTION (SIC Div. C)					1	1																			
* 16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26,31)	3	4		4 1 2	4	2 4	3	3	3 1 4	3		2	1	1		2	1	2 3 3 2	2 3 1 4		1			2	2 1 6 1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30,32)					1							1													1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)				3 1 3	1																				1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1	2		3 1 3	2	2 4	1	1	3	3 3 2		1 R	1			2									1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)				1						1							1				1				1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)				1					1							1									1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3				2								1												1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		2 R			4 R	?																		2	2
24 HEALTH SERVICES (SIC Major Gp 80)				2 2 1 R					1							1								1	1
25 GENERAL PUBLIC		1 R																							1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF FOOD/TOB/TEXTILE APPAREL/LBR/ETC. (SIC 20-26, 31) / MEASUREMENT SECTOR	USERS	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds. Labs & Reg. Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROC/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, Bal I,27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY																	3									
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS						1 R										2	4			2 R					2	4
3 VIBRATION & SHOCK																										
4 SURFACE FINISH	3 2 2		4 3 2	3 2 2 R	4 2	1 R			?		?	4 2		4 2 R			4 2		4 3 R	4 3 R	3 2 R	1 R			3 1 1
5 MASS, VOLUME & DENSITY			1	1 R			4 R	2 1 R	2 1 R		1	1	2	1	3		4			2 R			1	2 3	1	3
6 FORCE	2 2		2 3	3 R	1 2	R		2 3 R	2 1		2 3	2 1	?	2 3	3		2 4			2 R			2 2	2 3		2 1 2
7 FLUID FLOW			1	1 R													3									
8 PRESSURE			1	2 R	1	R											3									
9 TEMPERATURE			3 1 2	3 2 R	3 3 2	R		2 1 1 R	2 1 1		2 1 1			2 1 1			3 1 4			2 R		1 R	2 R		2 3 2 2
10 HUMIDITY & MOISTURE	2		2	2 2 R	2 2	R					1	2		1	2		3			2 R						
11 THERMODYNAMIC PROPERTIES OF FLUIDS	X		X	X	X																					
12 CRYOGENICS			1														2							1		
13 ELECTRICITY																	1									
14 ELECTROMAGNETICS																	1									
15 MEDICAL ULTRASONICS																										
16 ACOUSTICS	1			1					2 3 R 2		X	1	2	2		2 R	2			2 R						1
17 RADIOMETRY & PHOTOMETRY	1																1					1 R				
18 SPECTROPHOTOMETRY	1		2 2 2	3 2 2 R	2 2 2	R		2 1 2 R	2 2 2		2 1 2	2		2 2 2			2 3 2							1		3 2 3 2
19 FAR ULTRAVIOLET RADIOMETRY	2 2 2		?	2 1 R					2 3 1 2								2 3 1 4									
20 OPTICS																										
21 LASERS			2	1 R	1	R			1			1		2			1					1 R				
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																										
23 SURFACE PROPERTIES																										
24 IONIZING RADIATION			1	1 R	1	R			1		1	2					2									
25 AVERAGE	1		3 1 1	3 2 1 R	3 2 1	R		2 1 R	3 1 2 R	1	1	1	1	3 1 2	1	1	2 1 6 1		1 R	1 R	1 R		1 R	1		2

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1 = Purely convenience
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3 = No real alternatives
4 = Essential

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USERS

C D
A
B R

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4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

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1 = Minor
2 = Moderate
3 = Important
4 = Major

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Sector 17. Chemicals, Petroleum, Rubber, Plastics, Stone, Clay, Glass (SIC Major Groups 28-30, 32).

Chemicals and allied products--industrial gases, inorganics, pigments, nuclear fuels, plastics & resins, synthetic rubber, synthetic fibers, drugs, medicinals, pharmaceuticals, soap, cleaners, toilet goods, paints, gum & wood chemicals, organics, fertilizers, agricultural chemicals, adhesives & sealants, explosives, ink. Petroleum and coal products --petroleum refining, paving & roofing materials, lubricating oils & greases. Rubber and miscellaneous plastics products--tires, footwear, hose & belting, miscellaneous plastics products. Stone, clay and glass products--flat glass, glass containers, cement, structural clay products, vitreous plumbing fixtures, food utensils, porcelain electrical supplies, pottery products, concrete block & related products, lime, gypsum products, stone, abrasives, asbestos products, gaskets, packing & sealing devices, mineral wool, refractories.

This group of industries is significantly more measurement intensive than the previous group. It is based substantially on high technological processing of natural materials, rather than upon the relatively simple mechanical or traditional processing techniques of the previous sector. This conclusion is supported by both the greater intensity of NBS interactions and higher rankings in tables of value added by measurement-related activity. The kinds of measurements involved are dominantly those of process control parameters; this sector probably has the broadest range of, and most severe requirements for, such measurements of any of the economic sectors used in these matrices.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO CHEM/PETR/RUBBER PLASTICS/GLASS.. (SIC 28-30, 31) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof, Soc. & Publ.				3 3 2	2 2	1	1 2	2 2	2	2	3 2 3	2 3	2 1 1 2			2	1	2 2 3 2	2 3 1	1	4 3	1	3 2 3		3 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		1		3 3 2	2 1	3 3 2	2 3 2	2 1 1	1	2 1 3	2 2 2 1	2 3 2	2 1 1 2			1		2 3 2	?	2	1		2 2 1 1	4	2 1 2 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	2		2 2 1	2 2 2	2 2	3 3 2	3 1 4 1	4 1 4 2	2 1 3	2 1 3 2	1 4	3 1 3 3	1		3	1	2 3 4 2	2 2 2	2	2	1	3 1 3 3	4	3 1 3 1
5 NBS		3 1 3		2 2 1	2 2 1	1 2	2 2	2 1 3 1	2 1 3 2	2 2 1	2 3 3	2 1 3 2	3 1 1 2			1		2 3 2 2	2 2 1 4	1			3 2 3 2	2 2 4 2	2 2 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					1	1			1 1 2			2 1 2													1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1	1		1	1	2 3	2 1 2	2 1	1	1		2 1	3 1 2	1		3		2 1 3 2	2 2 1 4	1			2 2 2 2	3	2 1 2 1
9 REGULATORY AGENCIES (excl. OWM's)					3 1 2 R	3 1 2 R	3 1 2 R		3 1 2 R			2 1 2 R	3 1 3 R	1 R		2 R	1 R	1 1 1 R	3 2 1 2	3 R	4 2 R			4 R	3 1 2 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)					1 R	2 1 R	1 R				2 2 1 1	1 R	3 1 1 2 R			X							2 2 2	3 R	2 1 1 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)					1 R	1 R	1 R		1		2 2 1 1 3	1 1	3 1 1 2					2 2 2			1		2 2 2	4 R	2 2 2 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. DWM's & Reg. Ag.)							1					1 1 2				1 R					3 3 1 R				1
13 INDUSTRIAL TRADE ASSOCIATIONS		3		2 2 2			3		1 1		2 2 3	1 2				1		2 1 2 2			1				2 1 1 1
14 AGRICULTURE, FORESTRY, FISHING: MINING (SIC Div. A & B)					4	3	4	2		1		1 R												2	2
15 CONSTRUCTION (SIC Div. C)					1	1	1																		
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)																									
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY GLASS (SIC 28-3D, 32) *	3	1 1 3		3 1 3	2 4	2 4	4	2 1 4	3 1 4	1	2 2 3 2	1 3	2 1 3 3	1		2	1	2 3 4 2	2 3 2 4	2	2	1	4 2 3 3	4	2 1 6 1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1			1							1								2 R			2 2 2	1 R	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1	2 1 2			2	2 3	2	1	1	1		1				2									1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)													3 1 2 2	1			1			2	1		2 2 2 2	1	1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		1 R			1		1				2 1 1	1 1	2 1 1 2			1							2 2 2		2 1 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3				2		1	2 1 1				1 1	1							1 R				1 R	1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1 R			1 R	?																		4	2
24 HEALTH SERVICES (SIC Major Gp 8D)					1 R				1							1								2	1
25 GENERAL PUBLIC		1 R		3 1 R																				2 R	1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF CHEM/PETR/RUBBER PLASTICS/GLASS.. (SIC 28-30, 32)	SOURCES																								
MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS DOCUMENTARY STANDARDS ORGANIZATIONS INSTRUMENTATION INDUSTRY	3	4	5 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	6 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWMS) STANDARDS & TESTING LABORATORIES AND SERVICES REGULATORY AGENCIES (excl. OWM's)	7	8	9 DEPARTMENT OF DEFENSE (excl. Stds. Labs) CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) INDUSTRIAL TRADE ASSOCIATIONS	10	11	12	13 AGRICULTURE, FORESTRY FISHING, MINING (SIC Div. A & B)	14 CONSTRUCTION (SIC Div. C)	15 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	16 CHEM/PETRO/RUBBER/ STONE/CLAY/GLASS.. (SIC 28-30, 32)	17 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 39)	18 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	19	20	21	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27)	23	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY																3									
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS			1		2 1 1 R					3 R			2			1 3	1		2 1 1 R				1		2
3 VIBRATION & SHOCK																									
4 SURFACE FINISH	1		2 1 2 1 R		2 1 1 R					3 2 2 R						3 1 3			1 R				3 2		1
5 MASS, VOLUME & DENSITY	1	2 2 1 2 2 1 R			3 2 1 R	2 R 1		2	1				2 1	3	3	1	2 4	1 R	1 R	1	1 R	2	1	3	2
6 FORCE	2 2	2 2 2 R			1 2 R	2 3 R 1		2 2	2 1 ?		2	2 3	2 3			2 4		1 R			2 1	2 2		2 2 2
7 FLUID FLOW	1	2 1 R				1 R 1						4	1			4		2 R			2	1			
8 PRESSURE	2 1	2 1 3 R			2 1 R	1 R				1		2				2 4		1						2 1 1	
9 TEMPERATURE		3 1 3 3 2		2	3 3 4 2 R	2 1 1 R 2 1		2 1		2 1 1		1	1	1 R		3 4		1					1		
10 HUMIDITY & MOISTURE		1 1 R			1 R			1	1			2				1		2 1 1							
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 2 3 3	2 3 2 R 2			2 3 3			1 1 2 2 3	1 2	2 1 2 3		2 1 3				2 2 3 2		2 1 2			2 1 2				
12 CRYOGENICS	2 3	2 1 3 2 R			2 1 3 R	2 1 1 2 2		1 1 1 2	1 1 1 1 2	1 2		1	1			1 3		1 R		1 1	1 1				
13 ELECTRICITY		2 1 1 2 R			2 1 1 2 R	2 2 R		3 1 2								2 3 3	1	1 R							
14 ELECTROMAGNETICS																1									
15 MEDICAL ULTRASONICS																									-
16 ACOUSTICS		2 R				2 R 3		X	2	2			1 R			2									
17 RADIOMETRY & PHOTOMETRY	1															1			1 R						
18 SPECTROPHOTOMETRY	1	2 3 2 2 2 3 2 2 R			2 1 2 2 R	2 1 2 R		2 2 2								2 4 2	3					1		2 1 2 2
19 FAR ULTRAVIOLET RADIOMETRY	2 2 2 2	2 2 ? 2 2 R			1 3 1	2 3 2 2		2 2 1 2	2 2 1 2							2 2 4	3								
20 OPTICS	1	2 1 R			1 R	2		1	2							2			1 R		2				
21 LASERS	2	2 2 R			1 R	2		1	1	2						2			1 R						
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																1									
23 SURFACE PROPERTIES	2 2 2	2 2 3 1 2 3			3 2	2 2 1 2		2 2 2 2	2 2 2 2							4 3 2	2 2 2		2 2 2 2 2 2						
24 IONIZING RADIATION	2	3 3 R			3 R	C R 4		3	4			3				4	3		1 1		2	3		R	1
25 AVERAGE	2 1 2 1	2 2 1 2 2			2 1 2	2 2 1 2		1 2 1	2 1 2	2 1 1		2	1	1		2 1 6	1		1	1	1	1	1		1

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KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 18. Primary and Fabricated Metal Products (SIC Major Groups 33-34 and 391).

Primary metal industries--iron & steel, nonferrous metals, wire, pipe, tube, plate, sheet, foil, extruded products, metal heat treating, electrometallurgical products. Fabricated metal products--cans & shipping containers, cutlery, tools, hardware, heating equipment, household furnace humidifiers, structural metal, nuclear reactors, doors, prefabricated metal buildings, screw machine products, bolts, nuts, rivets, washers, metal forgings & stampings, plating & polishing, metal coating, ammunition, nuclear bombs, ordnance, valves, jewelry, silverware, and plated ware.

The industries in this sector depend upon both measurements of process control parameters and upon careful dimensional control of the fabricated products. Included here are the fabrication of both nuclear reactors and nuclear bombs. In terms of value added by measurement-related activity, this sector is somewhat less measurement intensive than the preceding one. In terms of NBS interactions, it is substantially more measurement intensive.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO PRIMARY & FA8. METAL PRODUCTS (SIC 33-34, 391) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)			1	2 2 2		3		2 2	1		2 1 1 2		2 1 1 2			2		1		2	4 1		3 2 3 3	4	3 1 2 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 4		3 2 2		3 4 2			1	1	2 1		2 1 2			1				3	1		2 2 1 1	4	2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	2 1 3	1	2 1 3	1	2 3	1	2 1 1	4 1 4 2	2		2	3 1 3 3	1		3		1		3	1		3 1 3 3	4	3 1 4 1
5 N8S		3 1 4		2 1 2	1	1 2		1	2 1 3 2		1 1 2		3 2 1 2							4 4			3 2 3 2	4 3 2 4	4 2 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)									1 2 1 2																
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1	2 1 1	1	2 1 2	2	2 4	1	1	1	1			3 1 2 2	1		3				4 3			2 2 2 2	3 3 2	3 1 2
9 REGULATORY AGENCIES (excl. OWM's)					1 R	3 2 2 R	1 R		3 1 2 R				3 1 1 3 R	1 R		2 R				1 1 4 R	4 2 R			4 R	3 1 2 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		2 R	1 R	3 3 R	1 R	2 2 R							3 1 1 2 R			X				3 R			3 2 2	4 R	3 1 2 1 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		1 R		3 2	1 R	1 R			1				3 1 2 2							4 2 R	3 1		2 2 2	4 R	3 2 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)					1 R											1 R					3 1 R				1
13 INDUSTRIAL TRADE ASSOCIATIONS		3		4 3					1 1							1					1				1
14 AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B)		2 1 2 R			4	2	1	2 R					1											1	2
15 CONSTRUCTION (SIC Div. C)		1 R			1 R	1				2 R										1 R					1 R
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				4 1 3 R																					1 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					1 R																		2 2 2 2	3	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) *	3	1 1 4	1	3 1 4	3	2 4	1	1	3 1 4	2	2 1	1	2 2 2 2	1		2		1		4 4	1		4 2 3 3	4	3 1 6
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1	3 1 4		3 1 3 R	1	2 3		1	2							2									2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)		1		4 2 2 1 R					1				3 1 2 2	1						3	1		2 2 2 2	2	1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2 1 2 R		3 1 3 R		1 1							2 1 1 2			1				1 R			2 2 2 2	2 R	2 1 1 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3				2	1 1							2							3 R				3 R	1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1 R			1	?				1 R														4	2
24 HEALTH SERVICES (SIC Major Gp 80)																1								2	1
25 GENERAL PUBLIC		1 R		3 2 R	1 R					1 R														2 R	1 R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) — USERS / MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, J-27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY																			3						
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 1		2 1 3	2 1 2 R	3 1 2 R					1			2	2 1 4	1				1 1 4	2 1 3	2	2 1 3	1	1		1
3 VIBRATION & SHOCK										1									1							
4 SURFACE FINISH	2 1 3		4 3	3 3 R	3 2 2 R			1 R		3 3	2		4 4			3 1 3			3 1 4	3 1 3	3 3	4 4			3 1 3	3 1 2
5 MASS, VOLUME & DENSITY			1				1	1 R	1	2	1	1		1	1	1	1		3	1			1	2		1
6 FORCE	2 2		2 3	3 R	1 2 R			2 3 R	2 2	2 1	2 2	?	2 3	2 3	2 3				2 4	2 3	2 2	2 3	2 3	2 2		2 3 2
7 FLUID FLOW														1					1							
8 PRESSURE	1		2 1	1 R	2 1 R									1					1							
9 TEMPERATURE			3 1 3	3 2 2 R	3 3 2 R			2 1 1 R	2 1 1				2 1 1						3 1 4	1 R						
10 HUMIDITY & MOISTURE			1	1 R															2					1		1
11 THERMODYNAMIC PROPERTIES OF FLUIDS																			2 1							
12 CRYOGENICS																		1	1	1						
13 ELECTRICITY			2 1 1 2	3 1 1 2 R	2 2 2 2 R			2 2 2 R		3 1 2	3 1 2								2 2 2							
14 ELECTROMAGNETICS																			1							
15 MEDICAL ULTRASONICS																										
16 ACOUSTICS	1			2				2 3 R		X		2	2		1 R				2	2 R						1
17 RADIOMETRY & PHOTOMETRY																										
18 SPECTROPHOTOMETRY			1																1							
19 FAR ULTRAVIOLET RADIOMETRY																										
20 OPTICS	2		2	1 R	2 1 1 R			4 3 R	3	3	3				4 1 2 2			2 R	4 4		2 R	1	4 1 4 2			4 2
21 LASERS	1		2	1 R	1 R				1	1	1		2						1		1 R					
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																										
23 SURFACE PROPERTIES	2 2 2		2 2 1 2	3 2 2 2	3 2 3			2 2 1 2		2 2 2	2 2 2						2 2 2		4 2 3		2 2 2	2 2 2				
24 IONIZING RADIATION	3		4	4 R	3 R			2 R	4	4	4			1 R			1 R		4		2 R	2	4	3	1 R	1
25 AVERAGE	2 1 1		3 2	3 1 2 1 R	3 2 1 2 R		1	3 1 R	2	3 1 2 1	2	1	2	2	1	1	1		3 6	2 1 1	1	3 2	2	1	1	1

KEY TO MATRIX ENTRIES

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R = Flow of requirements info dominates

USERS

C D
A
B R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
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A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 19. Machinery, except Electrical (SIC Major Group 35).

Turbines, turbine generators, internal combustion engines; farm, lawn, garden, construction, mining, oil field, rolling mill, metalworking, food products, textile, woodworking, paper industries and printing trades machinery; elevators, conveyors, cranes, industrial trucks & tractors; machine tools; ball & roller bearings; pumps, compressors, blowers, fans; industrial patterns; speed changers, drives, & gears; industrial furnaces, ovens, and cryogenic machinery; typewriters, electronic computing equipment, calculating & accounting machines; scales & balances, except laboratory; automatic merchandising machines; commercial laundry, refrigeration, & heating equipment; humidifying equipment, except household furnace or room electric; carburetors, pistons, rings, & valves.

This sector is one with which many parts of the NBS Institute for Basic Standards have substantial interactions. Many elements of this sector are quite measurement sensitive, e.g., ball and roller bearings, oil field machinery, office and computing machines, and machine tools. The machine tool industry is sufficiently important in the measurement system that it was handled as part of the measurement instrumentation sector in the measurements transactions matrix prepared by the microstudy on length and related dimensional measurements.

The products of this sector will not fit and will not work if they are improperly fabricated; dimensional, surface finish, and materials strength measurements are vitally important.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO MACHINERY, EXC. ELECTRICAL (SIC 35) — SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY	LENGTH & RELATED DIMENSIONAL MEASUREMENTS	VIBRATION & SHOCK	SURFACE FINISH	MASS, VOLUME & DENSITY	FORCE	FLUID FLOW	PRESSURE	TEMPERATURE	HUMIDITY & MOISTURE	THERMODYNAMIC PROPERTIES OF FLUIDS	CRYOGENICS	ELECTRICITY	ELECTROMAGNETICS	MEDICAL ULTRASONICS	ACOUSTICS	RADIOMETRY & PHOTOMETRY	SPECTROPHOTOMETRY	FAR ULTRAVIOLET RADIOMETRY	OPTICS	LASERS	PHYSICAL PROPERTIES OF ATOMS & MOLECULES	SURFACE PROPERTIES	IONIZING RADIATION	AVERAGE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1 KNOWLEOGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)		1 1 1	2 1	2 2 2	2 2 1	3	1	1		2 1 3	2 1 2 3		2 1 2 2	1		3				1	1				2 1 2 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS					2 4 2 4	2																			1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 4	2 3 2	3 2 3	3 1 3 2	3 4 2	1	2 2		2 1 3	2 1	1	2 1 2 2	1		2				2					2 1 2 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	2 1 4	2 1 1	2 1 3	2	2 3 1	1	3 1 4 1	4 1 4 2	3 1 3	2 1 1	1	3 1 3 3	2		3				2	1				3 1 5 1
5 NBS		3 1 4	2 3 1	2 1 2	2 1 2 1	1 3		2 2	2 1 3 2	2 1 2	2 1 1 2		1	1						4 2					2 1 2 1
6 OTHER U.S. NATIONAL STANDAROS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					3 1 3 2 R	3 3			1 2 1 2																3 1 2 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1	2 1 2	1	2 1 2	1 R	2 3	1	1	1	1			3 1 3 2	1		2				4 2					3 1 1
9 REGULATORY AGENCIES (excl. OWM's)			1 R		1	2 3 R	1 R		3 1 1 2 R				3 1 1 3 R	1 R		4 1 4 2 R				1 1 2 R	4 1 R			4 1 2 1 R
10 DEPARTMENT OF OEFENSE (excl. Stds. Labs)		4 R	2 2 2 R	3 R	2 1 3 N R	2 3 R	1 R		1 R	1 R			3 1 3 2 R	3 2 2 R		X				1 R					3 1 2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)			2 3 1 R	3 2	2 1	1 R	1 R		2	2			3 1 3 2	1 R							1				3 1 1 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1 R			1 R	1 R	1									1 R									1
13 INDUSTRIAL TRAOE ASSOCIATIONS		3		4 4	3	3			1 1				1	1		1									2
14 AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B)		2 1 3 R			1 R	2	2 R	2	1	2 R			1 R												1
15 CONSTRUCTION (SIC Div. C)		1 R				1	1 R	1	1	1 R															1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 2D-26, 31)		2 R		4 1 3 R	2 R	2 R			2 R	2 R						2 R									1 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)		2 1 1 R		1 R	1 R	1 R	2 R	1	1	2 1 1	1 2 1	1 R	1 R												1
18 PRIMARY & FAB. METAL PRDDUCTS (SIC 33-34, 391)		2 1 3		3 1 3	1	2 3			1 R			1				2 R									2 1 1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	2	2 1 4	1	3 1 4	3	2 3	2	2	3 1 4	2 1 3	2	2	4	2		2 1 3 2				4 2	1				3 1 6
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)		2 1 2	1	4 2 1		2 3			1 R	1 R			4	2		1 R				2	1				2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2 1 2 R	1	3 1 2 R	1 R	1 1	1 R		1 R			1 R	2 1 1 2			1				1 R					2 1 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2		2 1 1		2	1 2	1 R		1			1 R	2												1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)					3 R	2 3 R	1 R		2 R	1 R															1
24 HEALTH SERVICES (SIC Major Gp 80)				1 R					1	1 1 R						1									1
25 GENERAL PUBLIC		1 R	1 R	3 1 R	1 R	1 R	1 R																		1 R

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DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF MACHINERY, EXC. ELECTRICAL (SIC 35) — USERS / MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (OWM's) 9	DEPARTMENT OF DEFENSE 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY																1	1	1	2				1		
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 2		2 1 2	2 1 3 R	3 1 3 R			2 1 1 R		3	2	2	2	2 1 4	2	2	2 1 2	3 1 4	2 1 4	2 1 3	2 1 4	1			1
3 VIBRATION & SHOCK	1		1	1 R	2 1 R			1 R	1	2 2 2	1								1	1	1	2 1			
4 SURFACE FINISH	2 1 3		4 3	3 3 R	3 2 2 R			1 R		3 3	4 3		4 4			3 1 3		3 1 3 R	3 1 4	3 3	4 4				3 1 1
5 MASS, VOLUME & DENSITY	1	2	3	3	3 R		2	2	1	2	2	1		1	2	2	2	1	3	1	2	4	4	2	4
6 FORCE	1 2	2	2 3	2 3 1	2 3 R		2 2	3 R	2 2	2 3	2 3	1 3	2 3	2 1	2 2	2 4	2 3	2 3	2 3	2 2	2 3	2 4	2 4	3	2 4
7 FLUID FLOW	1		1	1 R					1	1	1	1		3	2	1	2		2			2	1	1	1
8 PRESSURE	2 1			1 R								1		1		1	1	1	2 2	1		?	I	X	1
9 TEMPERATURE			3 1 2	3 2 3 2 R	3 3 2 R		2 1 1 R	2 1 1 R	2 1 1	2 1 1	2 1 1	2 1 1	2 1	1	1	3	1	2	3 1 4	1	2	1	3	1	2 3 1 2
10 HUMIDITY & MOISTURE	2 2		1	2 1 2 R	1 R					1	2	1		2 3 2	1	3 3 2	1		2 1 3	2 2	1	1	3 3 2	3 2 2	1 1 2
11 THERMODYNAMIC PROPERTIES OF FLUIDS	1																		2						
12 CRYOGENICS			1													1 R	1		2		1	1	1		
13 ELECTRICITY			2 1 1 2	3 1 3 2 R	1 R			2 1 1 2 R		3 1 3 2 2	3 1 2		1	1		1			4	1 R		2			
14 ELECTROMAGNETICS	1									1			1						2	1	1				
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS	1		4 1 3	2 R	3 R			2 R	2 1 4 2	x	2	2	2	2	2	2	2	2	2 1 3 2	2	2	2			1
17 RADIOMETRY & PHOTOMETRY																									
18 SPECTROPHOTOMETRY																									
19 FAR ULTRAVIOLET RADIOMETRY																									
20 OPTICS	1			1 R	2 1 1 R			4 1 R	1	1	1								4 2	1 R	1	4 1 1 2			
21 LASERS			1	1 R															1	1 R					
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION																									
25 AVERAGE	2 1 1	1	3 1 2	3 1 2 1 R	3 2 R		1	2 1	1	3 1 1 1	3 1 1	1	2	2	1	1	1	2	3 1 6	2 1	3 2	2	2	1	2

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
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USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

R = Flow of requirements info dominates

? = Unknown, X = Not studied, Blank = 0

Sector 20. Electric and Electronic Equipment (SIC Major Group 36).

Transformers, switchgear, switchboards, motors, & generators, industrial controls, welding apparatus; household cooking equipment, refrigerators & freezers, electric humidifiers, laundry equipment, vacuum cleaners, sewing machines, small electrical appliances; wiring devices, lighting fixtures & equipment; radio & TV sets, phonograph records, telephone & telegraph apparatus, radio & TV communication equipment; electron tubes, cathode ray tubes, semiconductor devices, capacitors, resistors, coils & transformers, connectors; storage batteries, primary batteries; x-ray apparatus & tubes; engine electrical equipment.

This sector has become somewhat of a misnomer, in that it does not include either the electronic computers or electrically driven machinery of the previous sector, SIC Major Group 35.

Historically, it was the needs of this sector more than any other than generated the pressures that led to the creation of the National Bureau of Standards in 1901. Initially, it was electricity that needed measurement support. Today, the needs of electronics and electromagnetic communications equipment have been added. Three NBS divisions exist to support this economic sector. The measurements needed cover the total spread of electrical and electromagnetic quantities. Further, the electronic components industry has major needs for very demanding process control measurements, from time, pressure and temperature to the properties of input materials, to dimensional control of masking processes in integrated circuit manufacture that pushes both the limits of the state of the art and the absolute theoretical limits imposed by the fundamental facts of physics.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO ELECTRIC & ELECTRONIC EQPT. (SIC 36) — SUPPLIERS / MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2	2	2 1 3	3 1 3		1		3 2 1	1	2	1		2 1 3 2	3 1 4 1		3	3 2 3 2	2 2 2 2		1	3 3	3 3 4 2	3 2 3	2	3 2 3 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS	2 1 3	2 2	3 1 3		3 2 2				1	2 1 3 2			2 1 4 2	2 4 1		3	2 3 3 2 3 2	?	1	2		2 2 1 1	3	2 1 2 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	3	2 1 3	3 2 2	3 1 3	1	2 2	1	3 2 4 1 1 2	4 1 2	2 1 2		1	3 1 3 2 3	3 2 4 2		3	4 1 3 2 2	2 3 2	2	1	3	3 2 3 3 2	3 1 4 3	3	3 1 5 2
5 NBS	1	3 1 3 2	2 3 1	3 2 2		1 2		3 4 1	2 1 3 2	2 2 1			3 1 3 2	3 2 1		2	3 1 4 2	2 3 2			4 2 4	3 4 2	3 2 3 2	2 2 3	3 1 2
6 OTHER U.S. NATIONAL STANDAROS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)									1 2 1 2																
8 STANDARDS & TESTING LABORATORIES AND SERVICES	3	2 1 2	1	3 1 3	1	2 3	2	2	2	1			3 1 4 2 1	3 1 4 1		2	2 2 2 2 2	2 1 2	1		1		2 2 2	1	3 1 2 1
9 REGULATORY AGENCIES (excl. OWM's)	2 R		1 R			2 2 R	1 R	3 2 R	3 1 1 2 R				3 1 3 2 4 3 R 2 R		2 2 2 2 R		3 1 2 2 R				2 2 4 R		3	3 2 1 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		3 R	2 R	2 2 R		2 2 R			1 R	2 R			3 1 4 3 R 2 R	3 2 4 R		4 R	2 1 1 R				4	2 3 3 2	3 3 2	2 R	3 1 4 2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	3 R	2 R	2 2 1 R						1	3			3 1 3 3 1 2 2 R			1 R	2 1 2	1 2 1 2	1		3 3 2	4 3 3	2 2 2	1 R	3 1 2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																1 R					1 R				
13 INDUSTRIAL TRAOE ASSOCIATIONS				3 1 3					1 1				2	2 2 3 1		1	2 4 2	2 1 1 2			1				2 1 2 1
14 AGRICULTURE,FORESTRY, FISHING: MINING (SIC Div. A & B)	2 R															2 R									1
15 CONSTRUCTION (SIC Div. C)									1 R								1 R			2 R	1 R				1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				3 1 2 R													1 R				1 R				1 R
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					1												1 R			1 R	1 R		2 2 2	1	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2		3 3		2 2														2 R	1 R		2 2 2	2 R	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 3	1	3 3	1	2 2		1	1	2			1 R	1		2				1 R	1 R				2 1
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	3	1 1 3	2	3 2 3 2	2	2 2	2	2 2	1 3 1 3	2	1	1	4 4 2 3 3	3 2 4 3		3	4 4 2 2	2 3 2	2 1 3	2	3	2 3 2	4 3 3	3	3 1 6 3
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1 R	1 R	1	1		1 1			1 R				3 1 3 3	3 2 3		1	2 R			1 R	2 R		2 2 2	1 R	3 2 1 3
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3				1	1 1							3	3 2 3						2 R	2 R			2 R	1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)					1	2 1	1 R			1 R				1 R			1			1 R	2 R			2	1
24 HEALTH SERVICES (SIC Major Gp 80)													1 R	1 R		1	1			2 R	2 R			2	1
25 GENERAL PUBLIC	1 R	1 1 1 R	1 R	3 2 R	1 R				2 R	1 R			1 R			1 R	2 1 2 R				1 R			1 R	1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF ELECTRIC & ELECTRONIC EQPT. (SIC 36) / MEASUREMENT SECTOR	USMRS	KNOWLEDGE COMMUNITY (Science, Education, Prof., Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY		1			4	1	1		1	1											3	1	2			1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS		1		2 1 1	2 1 R	3 1 3 2 R			2 1 2 R		1	1							1	2 1 2	1 1 3	2 1 2	1	1		1 1 1
3 VIBRATION & SHOCK		1		1	1 R	2 1 R			1 R	1	2	1								1	2	2	2 1 1			
4 SURFACE FINISH		4 1 4 2		4 1 4 2	3 2 3 R	3 1 2 2 R			4 4 2 R		4 3 2	2		4 4			1		4 2 2 1 R	4 2 2 1	3 3 2	3 2			4 1
5 MASS, VOLUME & DENSITY									1 R												2					1
6 FORCE		1 1		2 1	1 R	2 1 R			2 2 R	2 1	2 1	2 2	?	2 1	2 3					2 2	2 2		2 2	2 1		2 1
7 FLUID FLOW																					2			1		1
8 PRESSURE		1		2 1	2 R	2 1 R															2 1 2					
9 TEMPERATURE				3 1	3 2 2	3 3 2 R			2 1 1 R	2 1 1	2 1 1	2 1 1	2 1 1	2 1 1		2			1	1 R	3 1 3	1	1	2		2 3 4 2
10 HUMIDITY & MOISTURE				1	1 R	1 R					2 1	1					1			1 R	2	1		1		1
11 THERMODYNAMIC PROPERTIES OF FLUIDS																					1					
12 CRYOGENICS																					1					
13 ELECTRICITY		3 1 3 2		2 1 3 2	3 1 4 2	2 1 3 2 R			3 1 4 2		3 1 4 2	2 1 3 2		2	1	1		3 1 2 2	3 1 2 2	4	4 2 4 3	3 1 2	2	1	1	1
14 ELECTROMAGNETICS		2 2 3 2		1 1 3 2 3 4 1 3 R		2 1 3 1 R			2 2 2 4 2 R	2 2 2 2	3 2 2 4 2	1 4 2		3 2 3 2				1	1	2	3 2 4 3	3 2 4 3	2 2 4 2	2	1	1
15 MEDICAL ULTRASONICS																										
16 ACOUSTICS		1		2	2 R	2 R			2 R	1	4	2	1	2	2					1 R	3					1
17 RADIOMETRY & PHOTOMETRY		2 2 3 2		2 1 4 2 3 2 R	3 1 2 R	2 3 2			4 1 3 2 2	4 1 2 2	4 1 2 3 2	4 1 3 2		3 1 4 2		3	1	1			4 4 2	3			2	4 1 3 2
18 SPECTROPHOTOMETRY				2 3 2 2 2 2 R	2 2 2 R	2 1 1 R			2 1 1 R		2 2 2										2 3 2					2 1 1 2
19 FAR ULTRAVIOLET RADIOMETRY		1			2 R					3 3 1 2	2 2 1 2										2 1 3					
20 OPTICS		1		2	3	1 R			2 R	1	3	2	1			3		2	3	2	2	2	3	2	4	
21 LASERS		3		3	3 R	1			1	2	3	3		3		1	1	1	1	1	3	2	2	3		
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES		2 3 2			2 3	2 3 2					3 2,3 4 3	2 4									2 3 2					
23 SURFACE PROPERTIES		2 2 2		2 2 3 2 1 2 2 2	2 2	3 2 2 3			2 2 1 2		2 2 2 2 2	2 2 2						2 2 2	2 2 2		4 2 3	2 2 2				
24 IONIZING RADIATION		2		2	2 R	2 R				2	2	2						1	2		3	1	2	1	2	1
25 AVERAGE		3 1 2 2		3 1 2 3 2	3 1 3 2	3 2 2			3 1 2 2	3 1 2 1	3 1 3 2 1	2 1		3 1 2 1	1	1	1	1	1	2	3 6 3	3 2 3	2	1	2	2 2 2

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
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USERS

C D
A
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A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
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3 = Important
4 = Major

? = Unknown, x = Not studied, Blank = 0

Sector 21. Transportation Equipment (SIC Major Group 37).

Motor vehicles, aircraft, ships, boats, railroad equipment, motorcycles, bicycles, guided missiles, space vehicles, travel trailers & campers, tanks, and related equipment & parts.

SIC Major Groups 36, 37, and 38 are the three primary areas of contact by the NBS Institute for Basic Standards with the industrial sectors of the economy. Major group 35 is only slightly behind. Debating the relative importance of these sectors is unproductive. Among them, they include all of the major high technology manufacturing sectors that require precise physical measurements to assure the proper functioning of their products. The present category includes the aerospace industry, which has long been very measurement sensitive, and the automobile industry which is experiencing performance and regulatory pressures that are causing it to begin to approach the aircraft industry in the nature and scope of its measurement needs.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO TRANSPORTATION EQUIPMENT (SIC 37) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	1	1 1	2 2 1	3 2 2		3	2 1 2	3 2 1		2	2 1 3	2 3	2 3 2	3 1 4 1		3		2 2 2		2	3		3 2 3 3	2	3 1 3 1
2 INTERNATIONAL METROLOGICAL ORGANIZTIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		2 1 3	2 2 1	3 1 3	1	3 4 2	2 3 2	2 3	1	2	2 1	2 3 2	2 1 3 2	2 2 1		2 1 4	1	2 3 2	?	3	1		2 2 1 1	2	2 1 2 1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	2 1 4	3 2 3	3 1 3	2	2 2	3 1 3 2	4 1 4 1	4 1 4 2	2 2		1 2	3 1 4 2	3 2 4 2		3	1	2 3 2		3	2		3 1 3 3	3	3 1 5 1
5 NBS	1	3 1 3 N	3 2 2 1	2 1 2		1 2	2 1 2	4 1 4 1	2 1 3 2	3 1 2	2 1 1 2	2 1 3 2	3 1 3 2	3 2 3 1		2 1 3 2		2 3 2		4 4	4 2 3		3 2 3 2		4 1 2 1
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES											2 1 2														
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)					1	1 1			1 2 2			2 1 2													1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	3	2 1 3	2 1 2 1	3 1 3	1	2 4	2 ? 3	1	1	1		2 2	3 1 3 2	2 2 4 1		3	1	2 1 2 2		4 3	1		2 2 2 2	2	3 1 3 1
9 REGULATORY AGENCIES (excl. OWM's)	1 R		2 R		3 1 2 1 R	3 4 2 R	3 1 3 2 R	3 R				2 1 2 R	3 1 1 3 R	3 2 4 2 R		4 1 4 2 R	1 R	1 1 1 R		1 1 3 R	2 R			2 R	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs).		4 R	2 R	2 2 R	1 R	2 3 R	4 R	2 1 R	2 R	2 R		1 1 R	3 1 3 R	3 2 2 R		X		2 1 2 R		4 R	2		3 2 2	3 R	3 1 4 2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	2 R	3 R	3 2 2 R		1 R	1 R	4 1 4 R	4 2 3	2	2		1 1 1	3 1 3 2	3 1 3 2 R		3		2 2 1 2		4 2 R	1		2 2 2	1 R	3 1 2 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1 R										1 1 2				1 R									1
13 INDUSTRIAL TRADE ASSOCIATIONS		2		3 3			2		1 1			1 2	2	2 2 3 1		1	1	2 1 1 2							2 1 1 1
14 AGRICULTURE, FORESTRY FISHING: MINING (SIC Div. A & B)		1 R			1 R	1	2	3	1 R		1 1 2	1 R													1
15 CONSTRUCTION (SIC Div. C)						1	1									1 R									1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)				1 R					1 R																
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					1 R							1 1											2 2 2 2	1	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		2 1 3		4 4		2 3														1			2 2 2 2	2	3 2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		2 1 4	1	4 4	2	2 3	2		2	1		1		1		2				1					3 2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1	2 1 2	2	3 2					1	1			3 1 2 2	3 2 4 3			3			2	2		2 2 2	1	3 2 3
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	2	1 1 4	2 3 2	3 2 3 2	2	4	4	4 1 3 1	3 1 3	2	2	1 3	2 2 3 3	3 2 4 3		2 1 3	1	2 3 2	1	4 4	2		4 2 3 3	3	3 1 6 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div E)	2	2 R	1		2 3	2	3 R	3 2 R	2 R			1 1	1	3 2 3 3		2 R				2				1 R	2 1 1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)		1 R			1		1 R		1 R								1							2	1
24 HEALTH SERVICES (SIC Major Gp 80)																1								1	1
25 GENERAL PUBLIC		1 R	1 R	3 2 R	1 R		1 R		1 R				1 R					1 R		1 R				1 R	1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF TRANSPORTATION EQUIPMENT (SIC 37)

USERS ↓ / MEASUREMENT SECTOR →

MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	NBS 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (except OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOVT AGENCIES (exc. Stds Labs & Reg. Ag.) 11	STATE & LOCAL GOVT AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE, FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal I,27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY				2 R	1 R			1 R	1												1 R	2	1		1
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 1		2 1 2	2 1 3 R	2 1 2 R			2 1 3 R		3	2	1	1	1			1 R	2 1 2 R	2 1 2 R	1 R	1 1 4	3	2		3
3 VIBRATION & SHOCK	1 2 2 N		2 2 2	2 2 2 R	2 2 2 R			2 2 2 R	2	2 3	2 2								1	1	2 3 2	1			
4 SURFACE FINISH	3 3 2		3 2 3	2 1 2 R	3 3 1 R			2 R		1	1		2 1 3				1	3 1 3 R	3 1 2 R	1	3 2 3 2			1
5 MASS, VOLUME & DENSITY			2 2					1 2 R	2 2	1	1	1	2 1 2 1 R	1	1		1		1 R		2	2 1 2	1		1 2
6 FORCE	2 2		2 3	2 R	2 R			2 3 R	2 2	2 2	2 2	2 3	2 3	2	2		1	1 1	1 1	1	4	2 2 1	2 1		2 1
7 FLUID FLOW	2 1 3		1	2 1 3 R	2 1 3 R			2 1 3 R	2 3	3	2 1 4	2	2	1	1		1		1 R		4	3			1
8 PRESSURE	1		2 1	2 2 R	2 2 R			1 R	2 2	3 2	3 2	1	2 2	1							4 3 1	4 3	2		3
9 TEMPERATURE			3 1 2	3 2 3 2 R	3 3 2 R			2 1 1 R	2 1 1	2 2	2 1 1	2 1 1	2 1 1	1	1		1		1 R	1 R	3 1 3	2	1		2 3 2
10 HUMIDITY & MOISTURE	2 1 1		1	2 1 2 R	2 1 N R					2	1										2	1			
11 THERMODYNAMIC PROPERTIES OF FLUIDS	2 1 1 2																	2 1 1			2				
12 CRYOGENICS	2 3		2 3 2	1 3 R	2 1 3 2 R	2 1	2 1 2	2 1 2	2 1 2	1 1	1 1 1	1 1 2	1		1		1 1		1 R		1 3	1 1			
13 ELECTRICITY	3 1 4 2		2 1 3 2	3 1 3 2	2 1 3 2 R			3 1 3 2 R		2 1 3 2	2 1 3 2		2		1			2 1 1 2	2 1 1 2	2 1 3 2	2 1 1 2	3 1 3 2	2 2 3 2	2 1 2		3
14 ELECTROMAGNETICS	3		2	3 2 4 2 R	3 R			2 2 4 2 R	2	3 2 4 2	2 1 3 2		3 2 2							3 2 3 2	3 2 4 3	3			3
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS	2		3	1 P	2 1 2 R				3 1 3 2	2	1	3 1 2	4 4	1	1	1	1	1	1	1	2 1 3	1			1
17 RADIOMETRY & PHOTOMETRY			1						1				1							2 R	1		1 R		1
18 SPECTROPHOTOMETRY			2 3 2 2 2 2	2 2 R	2 1 2 P			2 1 1 2 R		2 2 1 2								2 2 2 2			2 3 2 2				2 1 1 2
19 FAR ULTRAVIOLET RADIOMETRY																					1				
20 OPTICS	2		1	1 R	2 1 1 R			4 3 R	2	4	2								1 R	1 R	4 4	4 1 3 2			
21 LASERS	3		1	2 R	1								2							2 R	2				
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPEPTIES	2 2 2 2		2 1 2 2	3 2 2	3 2 3			2 2 1 2		2 2 2 2 2 2								2 2 2 2 2		2 2 2 2	4 2 3 3				
24 IONIZING RADIATION	1		2	2 R	2 R				2	3	1									1 R	3		1		
25 AVERAGE	2 1 2 1		2 1 2 1	3 1 2 R	2 1 2 R			2 1 2 1 R	2 1 2 2	2 1 2 2	2 1 2 1	2 1 1	3 1	1	1	1	1	2 1 1 1	2 1 1 1	3 1 2 1	3 6 1	3 2 1	1		1

KEY TO MATRIX ENTRIES

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1 = Purely convenience
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4 = Essential

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
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USERS

C D
A
B R

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

R = Flow of requirements info dominates

? = Unknown, X = Not studied, Blank = 0

Sector 22. Transportation and Public Utilities (SIC Division E).

Railroad transportation. Local & interurban passenger transit, including taxicabs & school buses. Trucking & warehousing. Water transportation. Air transportation. Pipe lines, except natural gas. Transportation services. Communication--telephone, telegraph, radio & TV broadcasting, other communication services. Electric, gas, and sanitary services, including sewerage & refuse systems; steam supply; irrigation systems. Note that the U.S. Postal Service is covered in sector 11 and omitted here.

This sector includes the top industry in terms of percentage of value added by measurement-related activities, and the three top industries in terms of total dollar amount of value added. Nevertheless, because the measurements tend to be of a more routine, operational-control, maintenance, or customer-billing nature, NBS interactions with this sector are relatively light.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof, Soc. & Publ.)	2	1	2 1				2 1 3 2	2 2			2 2 4	2 3	2 1 3 2	3 2 4 3		2		2 2 1 2	2 3 2 2	2	4 2			4	2 1 2 2
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	4 1 4																								1
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS		1	2 2 1 2		1	3 3 2	2 1 3 2	3 1 3			1 2 1	2 3 2	2 1 3 2	4 2 4 3		1		2 3 1 2	?	2	2			4	3 1 2 2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2 1 4 2	2	2 2 1 2		1		3 4 2	4 1 4 1	4 1 4 2	1	1 1 2	1 3	3 1 4 2	3 2 4 3		2		2 2 1 2	2 2 2 2	4	2			4	3 1 S 2
S NBS	3 1 4	1	2 2 1			1 2	2 1 3	4 1 4 1	2 1 2 2		2 2 2	2 1 3 2	3 1 4 1	4 3 4 3				2 3 1 2	2 3 1 4	2 1 3	3			4 3 4 4	4 2 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	4											2 1 2								2					1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	2				3	1 2			1 2 1 2			2 1 1 2													2
8 STANDARDS & TESTING LABORATORIES AND SERVICES	2 1 3 2		2 2 2			2 2	2 1 3 2	2 2	1			2 1	3 1 4 2	3 2 3 1		2		2 1 1 2		2	1			3 3 3 2	3 2 2 2
9 REGULATORY AGENCIES (excl. OWM's)	3 ? 4 R				3 1 3 1 R	3 4 2 R	3 1 4 2 R	3 R	3 1 1 2 R			2 1 2 R	3 1 3 3 R	3 1 4 2 R		4 1 3 2 R		2 3 1 4 R	1	3 R	3 2 R			4 R	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	2 R	1 R				2 3 R	3 R	2 1 R	1 R			1 1 R	3 1 2 R	3 2 2 R							2			2 R	2 1 2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		3	2 2 1 2 R			1 R	4 1 4 1	4 2 4	4	4	2 1 2	1 1 1	3 1 2	3 2 1 R		3		2 3 1 2	2 2 1 2	2 R	3 1			4 R	4 1 4 1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		2 R			1 R		2					1 1 2				1 R					1 R			2 R	1
13 INDUSTRIAL TRADE ASSOCIATIONS							3		1 1			1 2	2	2 3 1		1		2 2 1 2			1				2 1 1 1
14 AGRICULTURE, FORESTRY FISHING: MINING (SIC Div. A & B)					4 R	2 3	4	4	2 R	1 R	1 1 2	1												1	2
15 CONSTRUCTION (SIC Div. C)					2	2 2	1									1 R				2					1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)					1	2 2			2 R																1 R
17 CHEM/PETRDL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)					2	2 1	2				2 1 2	1 1								2				2	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1			1	2 3														4 1 4 2				4	2
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		1	2 2 1		4	2 4	2	?	1	1		1	2			2				4 1 1 2					2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	2	1	2 1 1			2 2			1				2	2 2 4 2						3	2			2	2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1	3	1		2 2 1	2 2	3	4 3	2	1		1 1	2 1 2 2	3		1				4 1 3 2					3 2 1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3 1 4 2	4	1		2 4	2 4	3 2 4 2	4 1 4 1	3 1 4	1	2	1 2	3 1 4 3	3 2 4 3		2		2 2 1 4	2 3 2 2	4	2			4	3 1 6 1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal I, 27)	1 R	1			2	2 2	1		2 R			1												4	2
24 HEALTH SERVICES (SIC Major Gp 80)																1								2	1
25 GENERAL PUBLIC	2 ? 3 R	1	1 R		1 2 R	2			4 R	1 R		1 R	1 R											2 R	2 R

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) / MEASUREMENT SECTOR	SOURCES	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc., & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 5	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (DWM's) 6	STANDARDS & TESTING LABORATORIES AND SERVICES 7	REGULATORY AGENCIES (excl. DWM's) 8	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 9	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds. Labs & Reg. Ag.) 10	STATE & LOCAL GOV'T AGENCIES (exc. Stds. & Reg. Ag.) 11	INDUSTRIAL TRADE ASSOCIATIONS 12	AGRICULTURE, FORESTRY & FISHING; MINING (SIC Div. A & B) 13	CONSTRUCTION (SIC Div. C) 14	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 15	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 16	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 17	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 18	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 19	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 20	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 21	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, Nos. 1, 27) 22	HEALTH SERVICES (SIC Major Gp 80) 23	GENERAL PUBLIC 24	
1 TIME & FREQUENCY		2 2			2 3 1 ?	3 1 4 2	3 1 2	2 3	2 3 ?	4	3	2		2	2	3	3	3	2	3	2	3 1 4 2	4	2	3 4
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS					1 R			1 R		1	2	2									2 R	4	2		2
3 VIBRATION & SHOCK		1		1	1 R	X			1 R		1								2 1 2		1	1			
4 SURFACE FINISH																									
5 MASS, VOLUME & DENSITY				1	1 R			3 R	2	1	1	2			4	2	2	2	2	2	1 2 3	2 4	2 3	1	2 1 3
6 FORCE		2 2		2 2		2 2 R		2 1	2 R 2	2 1	3	2 3		2 3	3	2			1	1 2	1 2	2 4	2 3		2 2
7 FLUID FLOW		2 1 3		2 1 3 2	2 1 4 R	3 1 3 R		2 1 3 R	3 2 4 R	3	2 1 4	3		3	3 4 2	1		1		1 R	3 R	3 4 2	1		1
8 PRESSURE		1		2 1	2 R	2 1 R		1 R	2					2 2	2			2 1 1			3 2 4 R	4 1 4			
9 TEMPERATURE				3 1	3 2 2 R	3 3 2 R		2 1 R	2 1 R	2 1	4 R			1 1	4	1 R				1	2 R	3 1 4	2	1	2 3 4 2
10 HUMIDITY & MOISTURE															2							1			2
11 THERMODYNAMIC PROPERTIES OF FLUIDS		2 1 1 2												2 1 1								2			
12 CRYOGENICS		2		2 3	1 3 R	2 1 3 R	2	1 1 2	2	1 1	1	1 1	1 1 2	1 1 2	1			1		1 R	1 1	1 2			
13 ELECTRICITY		2		2	3 1 2 R	2 4 3 R		2 R	2 1 3 R	3	2	2	2	2	1	1	1	1	2	2	3 1	3 4 3	2	1	3 1 4 3
14 ELECTROMAGNETICS		3 2 3 2		2 3	1 3 2 4 2 R	2 2 3 2 R		3 2 4 2 R	3 2 4 2 R	3	3 2 3	2 2 3		1 1 2 1							3 2 3 3	3 4 3			
15 MEDICAL ULTRASONICS																									
16 ACOUSTICS		2				3 R		2	3 1 3 R 2		1	3		3							2 R	2			1
17 RADIOMETRY & PHOTOMETRY																									
18 SPECTROPHOTOMETRY				2 1 2	1 R																	2 2 1 4			
19 FAR ULTRAVIOLET RADIOMETRY				?		2 1 1					1											2 2 2			
20 OPTICS				3	2 R	3 R	2 P	2 R	2		3					2 R		1 R	3 R		2 P	2	4		
21 LASERS		2		1	2 R	2			1	1	1		2								2 R		2		
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																									
24 IONIZING RADIATION		3		4	3 P	3 P		2 R	4	1	4	1			1 R			1 R	3 R		2 R	1 R	4	3	1	2
25 AVERAGE		2 1 2 1		2 3	1 2 2 R	2 2 3 1 R		2 1 2	3 2 2	2	2 1 2	1	2	2	2	1	1	1	1	1	2 1 2 1	3 1 6	2	1	3 1 4 1

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1 = Purely convenience
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C D
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Sector 23. Trade, Retail and Wholesale; Insurance, Finance, Real Estate; Personal Services; Printing and Publishing (SIC Div. F-H, bal. I; gp. 27).

Wholesale Trade--autos, construction matls, photo eqpt, electrical apparatus & appliances, TV & radio, electronic eqpt, heating & air conditioning, refrigeration, industrial machinery, transportation eqpt; drugs, apparel, groceries, chemicals, petroleum prod.

Retail Trade--bldg. matls, garden supplies, food, auto dealers & service stations, apparel, furniture, restaurants & bars; drug, jewelry, camera stores.

Finance, Insurance & Real Estate--banking, credit agencies, security & commodity brokers & services, insurance carriers, agents, brokers, real estate, holding & other investment offices.

Services (other)--hotels, laundries, beauty & barber shops, commercial photography & art, photofinishing labs; business, computer, & data processing services; auto, radio & TV, refrigeration, electrical, & watch & clock repair; motion pictures from production thru theaters; amusement, recreation, legal & social services; commercial radiation dosimetry, film badge, radiographic & x-ray inspection services.

Printing & Publishing--newspapers, books, magazines; commercial printing; photoengraving & related printing & publishing services.

Note: Health services are in sector 24. Educational services, professional organizations, etc. are in sector 1. Business associations are in sector 13. Independent R&D labs and engineering & architectural services are in whatever economic sector they support. Private households are in sector 25, General Public.

Trade, finance and real estate involve a tremendous dollar volume of value added by measurements. However, these measurements are sufficiently routine that the intensity of interaction with this sector by the NBS Institute for Basic Standards is very low. The primary contact mechanism is through the NBS Office of Weights and Measures.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO TRADE/FIN/RL EST/PERS SVS/PRINTNG (SIC F-H,Bal.I,27) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)		2 1 1															2 1 2 2		1	4 1			3	3 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS		1			2	3 3 2						1		1			2 3 2 2		2	2			3	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	4	2 1 3	1		3 1	2 1 1		3	4 1 3 2	1		1	2	2		1	3	2 3 2 2		3	2			3	3 1 5 1
5 NBS	3	3 1 1 N				1 2		1	2 1 1 2			1						2 3 2 2		2 1 1	3			4 4 3 3	4 3 1 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																				1					1
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	1	3 2 3			4 4 1	3 4			1 2 1 2	?															4 3 1
8 STANDARDS & TESTING LABORATORIES AND SERVICES	1	1	1	1	1	3 2	1	2 1	1	1		1	1	1		1	1	2 1 2 2		1				4 4 2 2	3 1 1 1
9 REGULATORY AGENCIES (excl. OWM's)	1 R				2 R	3 4 2 R			3 1 1 2 R				1 R			1 R		2 3 1 4			3 2 R			4 2 4 3 R	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		1 R			1 R	2 4 R															2			2 R	2 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)		1 R	1 R	1 R	1 R	1 R	1	1	2	1								2 3 1 2						2 R	1
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)		1 R			1 R											1 R					4 3 1 R				1
13 INDUSTRIAL TRADE ASSOCIATIONS					3	3			1 1							1		2 2 1 2			1				1
14 AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B)					2	2																			1
15 CONSTRUCTION (SIC Div. C)		1 R			1											1									1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31		2			2 3	2 3						1						1							1
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)		1			1	2 2	1											1						3	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1			2	2 2				1														3	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)	1				4	2 4	1	1	3	3 2		1													2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)		1				2 1	1		2	1			1	2						2	3			1	1
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)		2			1	2 1		2	1								1 R							1	1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	4	2			2 3	2 3	1		2				2											3	2
* 23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	4	2 1 4	2	1	4	2 4	1	2	3 1 3	1		1	4	2		2	3	2 3 2 2		4	2			3	7
24 HEALTH SERVICES (SIC Major Gp 80)	1 R	1 R			2 R	1		1	1				1 R								1			2 R	1
25 GENERAL PUBLIC	3 R	2 1 3 R	1 R	2 R	1 4 R	3		2 R	2 R				1 R	1 R			2 R	2 R		1 R	1 R			1 R	2 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF TRAQE/FIN/RL EST PERS SVS/PRINTNG (SIC F-H,bal.I,27) / MEASUREMENT SECTOR	USERS	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS 2	DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	N B S 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's) 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/FIN/RL EST/PERS SVCS/PRINT (SIC F-H, bal I, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY					3 R	1 R		1 R	1 R				1										1 R	4	1	4
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS		2 1 1			2 1 1 R	2 1 1 R		2 1 2 R			1	1	1		1	1	2 R	1 R	1 R			1 R	1	2 1 4	1	2 1 4
3 VIBRATION & SHOCK					1 R																			2		1
4 SURFACE FINISH																								1		1
5 MASS, VOLUME & DENSITY				2	3 R			4 R		1	1	1	2	3 R	2	2 R	4 R	1 R	1	3 R	1	1	2	4	1	4 2 4 1
6 FORCE			2 2		1 R	1 1 R		3 R	2 1 R	2 2	2 1	2 2	2 2	2 3	1 2	1 2	?	?	?	2 3 R	2 1		2 2	2 4	1	2 3
7 FLUID FLOW												1								1 R	1 R	1 R	1	1		2
8 PRESSURE					3 R							1	1			1								2	1	3
9 TEMPERATURE			3 1 1	3 2 1 2 R	3 1 2 R	3 1 2 R		2 1 1 R	2 1 1 R	2 1 1		2 1 2 R		2 1 1	1					2 R		1 R	2 R	3 1 3	1	2 3 2
10 HUMIDITY & MOISTURE																			1 R	1 R	1 R			1	1	1
11 THERMODYNAMIC PROPERTIES OF FLUIDS																										
12 CRYOGENICS				1				1															1	1		
13 ELECTRICITY					1 R																			4	1	2
14 ELECTROMAGNETICS					1 R																1 R			2		1
15 MEDICAL ULTRASONICS																										
16 ACOUSTICS					1 R																			2		
17 RADIOMETRY & PHOTOMETRY					1 R												1				1	1		3		2
18 SPECTROPHOTOMETRY		1		2 3 2 2 1 2 2 R	2 2 2 R	2 1 1 2 R			2 1 1 2 R		2 2 1 2													2 3 2 2		2 1 1 2
19 FAR ULTRAVIOLET RADIOMETRY																										
20 OPTICS				1	2 R	3 2 R			1 R		1	1									1 R			4		2
21 LASERS		1		2	2 R	1 R				2	1	1	1 3 1	3							2 R			2		
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																										
23 SURFACE PROPERTIES																										
24 IONIZING RADIATION		2		3		3 R			2 R	4	3	3			3		2	4	4		2	2	4	3	3	2
25 AVERAGE		1		1	2 R	3 1 1 R		2 R	1 R	2	1	1	1	1	1	1	2	2	2	1	1	1	2	7	1	6

KEY TO MATRIX ENTRIES

C - IMPORTANCE OF TRANSACTIONS

1 = Purely convenience
2 = Strongly desirable
3 = No real alternatives
4 = Essential

B - RATE OF CHANGE

N = Declining
0 = Stable
2 = Growing
4 = Growing explosively

R = Flow of requirements info dominates

USERS

C	D
A	
B	R

D - (IN)ADEQUACY OF SERVICES

0 = No improvements needed
1 = Could be improved
2 = Marginal
3 = Serious deficiencies
4 = Out of control

A - MAGNITUDE OF TRANSACTIONS

0 = Trivial
1 = Minor
2 = Moderate
3 = Important
4 = Major

? = Unknown, X = Not studied, Blank = 0

Sector 24. Health Services
(SIC Major Group 80).

Offices of physicians, dentists, osteopathic physicians, chiropractors, optometrists; nursing & personal care facilities; hospitals; medical & dental laboratories; outpatient care facilities, other health & allied services.

This is an economic sector that is a major user of measurements, despite its relatively low weighting in the transactions matrices. Of all of the major user sectors, this one is probably least well known by NBS, and more adequate study of it is in order. Increasingly, objective measurements are providing the basis for diagnosis and monitoring of a patient's condition, rather than the doctor's direct, subjective observations. Medical thermometry and simple height, weight, and blood pressure measurements are classical examples in the field. Electrocardiography, electroencephalography, x-ray pictures, ionizing radiation therapy, ultraviolet radiation therapy, and medical ultrasonics involve some newer examples. The measurement of the ability to see or hear is another major field of health service measurements.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO HEALTH SERVICES (SIC 80) — SUPPLIERS \ MEASUREMENT SECTOR	1 TIME & FREQUENCY	2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	3 VIBRATION & SHOCK	4 SURFACE FINISH	5 MASS, VOLUME & DENSITY	6 FORCE	7 FLUID FLOW	8 PRESSURE	9 TEMPERATURE	10 HUMIDITY & MOISTURE	11 THERMODYNAMIC PROPERTIES OF FLUIDS	12 CRYOGENICS	13 ELECTRICITY	14 ELECTROMAGNETICS	15 MEDICAL ULTRASONICS	16 ACOUSTICS	17 RADIOMETRY & PHOTOMETRY	18 SPECTROPHOTOMETRY	19 FAR ULTRAVIOLET RADIOMETRY	20 OPTICS	21 LASERS	22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES	23 SURFACE PROPERTIES	24 IONIZING RADIATION	25 AVERAGE
1 KNOWLEDGE COMMUNITY (Science, Education, Prof, Soc. & Publ.)				3 1 3	2 1 I 2		1		1	1		1	1	1	2 ? 4 2	3	1	2 2 3 2	2 3 1	2	4 2		1	4	2 1 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDARDIZATION ORGANIZATIONS				3 3 3	2 I				1	?			2 2 2	1	3	3	1	2 2 2	?	1	2			4	2
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	2	1		?	3 3	1	1	3 1 1	4	1			3 2 3	1	3	3	1	2 3 2	2 2 2	4 2 2	1		1	4	3 2 4 2
5 NBS				2 2 2	I 2 N			I	3	1			2 1 2	1	3 2 1 2	2 3 2		2 1 2 2	2 2 1 4	1 1				4 3 4 2	4 3 2 2
6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES																									
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)									1																
8 STANDARDS & TESTING LABORATORIES AND SERVICES					2 2 1			?	1				3 1 2 3			1		2 4 2	2 1 3	3				4 3 3 2	3 2 2 2
9 REGULATORY AGENCIES (excl. OWM's)					3 1 2 1 R								3 2 3 3 R	2 R	4 ? 3 2 R	4 3 3 4 R	2 R	2 2 R 2	3 2 1 R	2	4 1 R			3 R	4 2 2 3 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)		1 R			1 R								3 1 2 3 R			X				2 R			2 R	1 R
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs. & Reg. Ag.)		1 R			1 R		1		1	2			3 1 2 3		3	1	1	2		2 R	3 2			4 R	2
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)																					1 R			2 R	1
13 INDUSTRIAL TRADE ASSOCIATIONS				2 1 2														?			1				1
14 AGRICULTURE, FORESTRY, FISHING; MINING (SIC Div. A & B)																								1 R	
15 CONSTRUCTION (SIC Div. C)									1							1									
16 FOOD/TOB/TEXTILE APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)					1																				
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)				3 1 2	3				1															1 R	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)				3 1 3																				1 R	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)					2	3	1	X	1	3 2 2															I
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)													1	1			2			4				2	2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)																									
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	2				1				1				1											1	1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	1	1			I	1		1	1	1			1											3	1
* 24 HEALTH SERVICES (SIC Major Gp 80)	3	2		3 3 1 2	4	2	1	3	4	3 2 2		1	3 2 3	1	3	3 2 3	1	2 4 2	4 2 2	3	1		1	4	5
25 GENERAL PUBLIC		1			1 1	1			1 R				1 R		1 R					2 R	1 R			2 R	1 R

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF HEALTH SERVICES (SIC 80)

USERS

MEASUREMENT SECTOR	1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)	2 INTERNATIONAL METROLOGICAL ORGANIZATIONS	3 DOCUMENTARY STANDARDS ORGANIZATIONS	4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	5 NBS	6 OTHER U.S. NATIONAL STANDARDS AUTHORITIES	7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (Cert.)	8 STANDARDS & TESTING LABORATORIES AND SERVICES	9 REGULATORY AGENCIES (exc. OWM's)	10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)	11 CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.)	12 STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.)	13 INDUSTRIAL TRADE ASSOCIATIONS	14 AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B)	15 CONSTRUCTION (SIC Div. C)	16 FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31)	17 CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30, 32)	18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)	19 MACHINERY EXCEPT ELECTRICAL (SIC Major Gp 35)	20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, bal 1, 27)	24 HEALTH SERVICES (SIC Major Gp 80)	25 GENERAL PUBLIC
1 TIME & FREQUENCY				1 R																			1 R	3	2
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1			1 R						1	1												1 R	2	2
3 VIBRATION & SHOCK																									
4 SURFACE FINISH	3 3 2		3 2 2	2 2 R	3 2 R								2 2 3 R			2 2 1 R			1 R				3 3 1 2	
5 MASS, VOLUME & DENSITY	1			2 2				3 1 2 1		1	2 1 1						1 R						2 R	4	4 1 2 1
6 FORCE				1 R																			1	2	2
7 FLUID FLOW	1			1 R							1													1	
8 PRESSURE				1 R					?	1													1	3	2
9 TEMPERATURE			1	3 R	3 R		1 R		1						1	1	1		1				1	4	3
10 HUMIDITY & MOISTURE	2 1 1		1								1								1 1 R					3 2 2	3 2 1 2
11 THERMODYNAMIC PROPERTIES OF FLUIDS																									
12 CRYOGENICS																								1	
13 ELECTRICITY	1		2 2 2 2 2 2	2 2 R	2 1 2 R			3 1 2 R		3 1 2 3	1 R									1 R			1 R	3 2 3	1
14 ELECTROMAGNETICS	1			1 R					1											1 R				1	
15 MEDICAL ULTRASONICS	3		2	3 R	3 R				2		3													3	2
16 ACOUSTICS	2		1	3 R	2 R			2 R	2	x	2	2		1	1	1	1	1	1	1	1		1	3 2 3	1
17 RADIOMETRY & PHOTOMETRY	1		1	1 R					1 R											1				1	
18 SPECTROPHOTOMETRY	1		2 2 2 2 2 3 2 2	2 1 2 R					1															2 4 2	1
19 FAR ULTRAVIOLET RADIOMETRY	2 2 1		?	1 R					2 3 1 2	?	1													4 2 2	2 2 1 4
20 OPTICS	1		2	4 R					2	3	1	1								2 R				3	4 1 4 2
21 LASERS	2		2	2 R	1 R				1	1	2	1 3 1	2							2 R			1	1	1
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																									
23 SURFACE PROPERTIES																								1	
24 IONIZING RADIATION	3		3	4 R	4 4 2 3 P			3 R	3	1	2	1		2		1	2	2		2	1	2 R	2	4	3
25 AVERAGE	1		1	2 R	4 2 2 3 R			1 R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	S	2

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A
B R

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Sector 25. General Public

The person-on-the-street, housewife, automobile driver, private pilot, amateur radio operator, home do-it-yourselfer, camper, amateur sportsman; the worker as a private person on the job, being exposed to job safety & health hazards. The consumer, consumer advocate, public interest advocate, citizen taxpayer.

This sector has no SIC code, since it represents one of the ultimate consumption sectors of the economy, not a productive industrial sector.

We, as ordinary individuals, use many measurements in our every day lives. We read a watch or a clock to measure time. The odometer of our automobile measures itinerary distance. Speed is an even more often used measurement quantity--one that is policed. Dimensional measurements are important in home carpentry, sewing, and landscaping. "How tall are you?" and "What do you weigh?" are frequently asked questions.

We use and pay for cloth and carpets by the square yard, rope and chain by the foot or yard, taxis on the basis of miles and minutes, and rental cars by miles and days. We buy and use many bulk commodities by mass or volume: a pound of butter, quart of milk, cord of wood, gallon of gasoline.

We measure tire and barometric pressure. We use temperature measurements to tell us how to dress or to cook our food. Our activities are conditioned by wind velocity and humidity measurements reported by the weatherman. Our electricity bills depend upon a meter reading. The quality of the snapshots we take depends upon reading of a light meter.

The measuring devices around the home and garage include watches and clocks and metronomes, rulers and tapes and protractors and compasses, odometers and speedometers, scales and balances, measuring cups and spoons, tire gages and oil pressure gages, the eletric and gas and water meters, the humidity controller, light meter, and others, depending upon our personal interests.

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR INPUTS TO GENERAL PUBLIC

SUPPLIERS \ MEASUREMENT SECTOR	TIME & FREQUENCY 1	LENGTH & RELATED DIMENSIONAL MEASUREMENTS 2	VIBRATION & SHOCK 3	SURFACE FINISH 4	MASS, VOLUME & DENSITY 5	FORCE 6	FLUID FLOW 7	PRESSURE 8	TEMPERATURE 9	HUMIDITY & MOISTURE 10	THERMODYNAMIC PROPERTIES OF FLUIDS 11	CRYOGENICS 12	ELECTRICITY 13	ELECTROMAGNETICS 14	MEDICAL ULTRASONICS 15	ACOUSTICS 16	RADIOMETRY & PHOTOMETRY 17	SPECTROPHOTOMETRY 18	FAR ULTRAVIOLET RADIOMETRY 19	OPTICS 20	LASERS 21	PHYSICAL PROPERTIES OF ATOMS & MOLECULES 22	SURFACE PROPERTIES 23	IONIZING RADIATION 24	AVERAGE 25
1 KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.)		1 1 1					2 1 1		1 1	1			1	1 1 1	2 ? 1 2	1	1 3 1		4 2 2		-			2	2 2 1
2 INTERNATIONAL METROLOGICAL ORGANIZATIONS																									
3 DOCUMENTARY STANDAROIZATION ORGANIZATIONS		1			1	4 2 2		2 2 1	1			2 1 2	1						?		1			2	1
4 INSTRUMENTATION INDUSTRY (SIC Major Gp 38)	4	3			2	2 1	1	2 1 1	4 3 2	1			2	1			4 3 2			4 1 4 2				1	3 1 4 2
5 NBS	2 3	1 1 1	2 3 1			1 1	2 1	3 1 1	1 1 1	1 1		1 2 1 2				2	3 1 2							1 1	2 1 1
6 OTHER U.S. NATIONAL STANDAROS AUTHORITIES	1																								
7 STATE & LOCAL OFFICES OF WEIGHTS & MEASURES (OWM's)	1	3 1 1			4 1 3 1	1 2			1 2 2																4 1 1 1
8 STANDAROS & TESTING LABORATORIES AND SERVICES																		1							
9 REGULATORY AGENCIES (excl. OWM's)	1 R		1 R		1 R	3 4 2 R	1 R		4 3 1 2 R			2 2 1 2 R	3 R	1 1 1 R		3 2 2 4 R	4 3 2 2 R		2 2 2 2	1 R	1 R			2 R	3 1 2 2 R
10 DEPARTMENT OF DEFENSE (excl. Stds. Labs)																X								1	
11 CIVILIAN FEDERAL GOV'T AGENCIES (excl. Stds. Labs & Reg. Ag.)	1	2	1		1 1	1	4	3 4	4	1 4			1		1	3 1 2 2	2 1 1 2		2 2 1 2	1				2	2 3
12 STATE & LOCAL GOVERNMENT AGENCIES (exc. OWM's & Reg. Ag.)	1	2														2								1 R	1
13 INDUSTRIAL TRADE ASSOCIATIONS					1	1										2	1 1								1
14 AGRICULTURE,FORESTRY FISHING: MINING (SIC Div. A & B)					1	3 1 2											1							1	1
15 CONSTRUCTION (SIC Div. C)	1	3				3 1 2	1		2	1						3	1								1
16 FOOD/TOB/TEXTILE/ APPAREL/LBR/FURN/PAPER/ LEATHER (SIC 20-26, 31)		4		3 1 1	3	2 1 2			2 3 2 2							1		3 2 3 2						2
17 CHEM/PETROL/RUBBER/ PLASTICS/STONE/CLAY/ GLASS (SIC 28-30, 32)		2		1	2	2 2 2		2 1 1										2 1 2 2						1	1
18 PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391)		1		3 1 2	1	2 3 2				1						1				4 2				1	1
19 MACHINERY, EXCEPT ELECTRICAL (SIC Major Gp 35)		1		3 1 1	4	2 4	1	1	2 3 1 2	1 2						1									2
20 ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36)	1	1 1 1		4 1	1	2 1	1		2 3 4 2	1			1	1		1	4 1 3 2	2 1 1 2						1	2 2 2
21 TRANSPORTATION EQUIPMENT (SIC Major Gp 37)	1	3		1	1 2	2 1	1	3	2 3 2				3			1	1	2 1 2							1
22 TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E)	3 4	2			2 3	2 2	1		2 4 2	2			3 1 4 3			1								2	3 1 4 1
23 TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT-PUB (SIC F-H, bal. I, 27)	4	2 1 4	1	1	4 2 4 1	2 3	2	3	2 3 2	1			2	1			2	2 1 2		2				2	6
24 HEALTH SERVICES (SIC Major Gp 80)	2	2			4 1 2 1	2		2	3	3 1 2			1		2	1		1	2 1 2 4	4 1 4 2	1			3	2
25 GENERAL PUBLIC	4	1 1 4			1 4 1	3	1	2 2 1	3 1 4	1			2 1 2 3	1		1	3 3 2			1				1	2 1 7 1

*

DIRECT MEASUREMENTS TRANSACTIONS MATRIX FOR OUTPUTS OF GENERAL PUBLIC — U S S R S — MEASUREMENT SECTOR	KNOWLEDGE COMMUNITY (Science, Education, Prof. Soc. & Publ.) 1	INTERNATIONAL METROLOGICAL ORGANIZATIONS DOCUMENTARY STANDARDS ORGANIZATIONS 3	INSTRUMENTATION INDUSTRY (SIC Major Gp 38) 4	N S S R 5	OTHER U.S. NATIONAL STANDARDS AUTHORITIES 6	STATE & LOCAL OFFICE OF WEIGHTS & MEASURES (OWM's) 7	STANDARDS & TESTING LABORATORIES AND SERVICES 8	REGULATORY AGENCIES (excl. OWM's 9	DEPARTMENT OF DEFENSE (excl. Stds. Labs) 10	CIVILIAN FEDERAL GOV'T AGENCIES (exc. Stds Labs & Reg.Ag.) 11	STATE & LOCAL GOV'T AGENCIES (exc. OWM's & Reg. Ag.) 12	INDUSTRIAL TRADE ASSOCIATIONS 13	AGRICULTURE,FORESTRY FISHING; MINING (SIC Div. A & B) 14	CONSTRUCTION (SIC Div. C) 15	FOOD/TEXTILE/LBR/ PAPER/LEATHER/ETC. (SIC 20-26, 31) 16	CHEM/PETROL/RUBBER/ STONE/CLAY/GLASS... (SIC 28-30,32) 17	PRIMARY & FAB. METAL PRODUCTS (SIC 33-34, 391) 18	MACH/ELECTRICAL EQUIPMENT (SIC Major Gp 35) 19	ELECTRIC AND ELECTRONIC EQPMT (SIC Major Gp 36) 20	TRANSPORTATION EQUIPMENT (SIC Major Gp 37) 21	TRANSPORTATION & PUBLIC UTILITIES (SIC Div. E) 22	TRADE/INS/FIN/REAL EST/PERS SVCS/PRINT (SIC F-H, ba1 1, 27) 23	HEALTH SERVICES (SIC Major Gp 80) 24	GENERAL PUBLIC 25
1 TIME & FREQUENCY			2 ? 4 ? R	2 1 2 R	1 R	1 R					1 R									2 ? 3 R	3 R		4
2 LENGTH & RELATED DIMENSIONAL MEASUREMENTS	1 1 1 R		1 R	1 1 1 R		1 R				1 R	2 R			1 R	1 R	1 R	1 R	1 R	1 R	1 1 1 R	1 R	2 1 3 R	1	1 1 4
3 VIBRATION & SHOCK				2 2 1 R						1 R									1 R	1 R	1 R	1 R	1 R		
4 SURFACE FINISH																3 1 R	3 2 R	3 1 R	3 2 R		2 R			
5 MASS, VOLUME & DENSITY			1 R			3 1 3 1 R		3 2 1 R			1 R	1 R	1 R					1 R	1 R	1 R	1 R	1 4 R	1 R	1 4 1
6 FORCE			1 R	1 1 R								1 R						1 R	2	3	1		3
7 FLUID FLOW								2 R		2 R	1 R							1 R			1 R		1
8 PRESSURE			1 1 R	3 2 1 R			1 R			2 1 R	2 1 R	1 R									2 R		2 2 1
9 TEMPERATURE			2 3 1 2 R	1 R				2 1 2 R		4 R				2 R					2 R	1 R	4 R	2 R	1 R	3 1 4
10 HUMIDITY & MOISTURE			1 R															1 R		1 R		1 R		1
11 THERMODYNAMIC PROPERTIES OF FLUIDS																								
12 CRYOGENICS				1 2 1 2 R				2 2 1 2 R		3 2 1 2 R		2 2 1 2 R								1 1 R				
13 ELECTRICITY			1 R					2 R											1 R	1 R	1 R	1 R	1 R	2 1 2 3
14 ELECTROMAGNETICS																					1 R			1
15 MEDICAL ULTRASONICS																							1 R	
16 ACOUSTICS	1 P			1 P			1 R	1 3 2 R	X	2 R		2 1 2 R							1 R					1
17 RADIOMETRY & PHOTOMETRY		2 1 2 R		3 1 2 R				2 1 2 R		2 1 2 R									2 1 2 R		2 R		3 3 2
18 SPECTROPHOTOMETRY																						1 R	2 R	
19 FAR ULTRAVIOLET RADIOMETRY								3 R																
20 OPTICS			1 P	1 R				1 R		1 R	1 R								1 R			1 R	2 R	1
21 LASERS				1 R				1 R		1 R	1 2 R								1 R			1 R	1 R	
22 PHYSICAL PROPERTIES OF ATOMS & MOLECULES																								
23 SURFACE PROPERTIES																								
24 IONIZING RADIATION		2 1 P P		1 P				3 P	2 2 R R		2 R					2 2 R R			1 R	1 R	2 R	2 R	1
25 AVERAGE		2 P P		2 1 P		1 P		2 1 2 R	1 R	2 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 R	1 P	1 P	1 P	2 R	2 R	1 R	2 1 7 1

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A
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15. SUPPLEMENTARY NOTES

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)* The interactions among the various elements of the National Measurement System are described in a series of transactions matrices. The National Measurement System consists of all of the activities and mechanisms used by this country to produce measurement data. The transactions matrices describe both the flow of measurement knowledge, goods, and services from suppliers to users in this System, and the activities within a given supplier-user sector. Semiquantitative estimates are made for the magnitude of the transactions, the rate of change of that magnitude, the relative importance or criticality of the transactions, and their adequacy. Basic supplier-user matrices have been developed for the system as a whole and for some 24 different measurement sectors (time and frequency; length and related dimensional measurements; vibration and shock; surface finish; mass, volume and density; force; fluid flow; pressure; temperature; humidity and moisture; thermodynamic properties of fluids; cryogenics; electricity; electromagnetics; medical ultrasonics; acoustics; radiometry and photometry; spectrophotometry; far ultraviolet radiometry; optics; lasers; physical properties of atoms and molecules; surface properties; and ionizing radiation). Some 25 supplier-user sectors have been defined, ranging from technical infrastructural institutions through governmental agencies to a series of commercial-industrial sectors defined by Standard Industrial Classification codes, to the "general public". Combination of like rows or columns from the basic supplier-user matrices for the different measurement sectors has allowed the generation of total input and output matrices for each supplier-user sector.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)* National measurement system; measurement institutions; measurement activities; end-use measurements; time and frequency; mechanical quantities; thermal quantities; electrical quantities; electromagnetic quantities; acoustic quantities; optical quantities; ionizing radiation.

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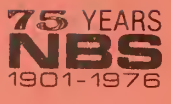
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